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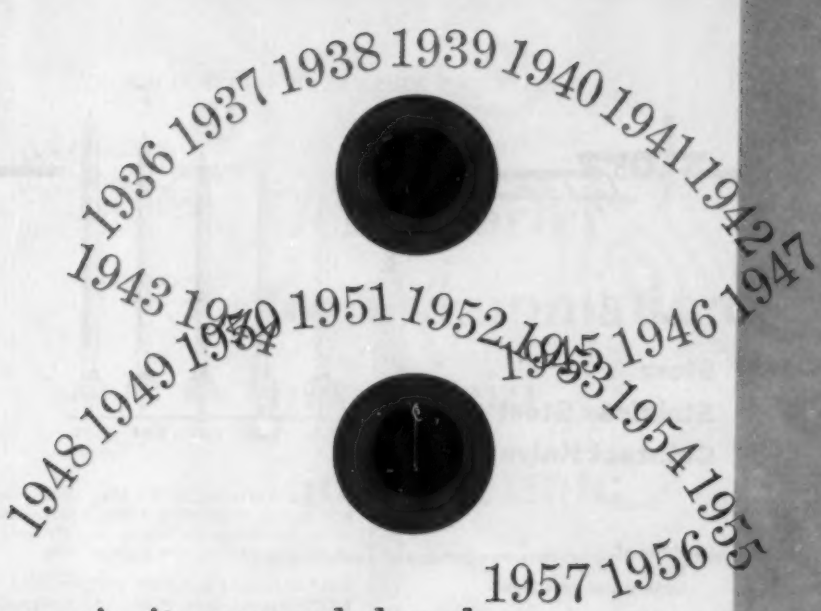

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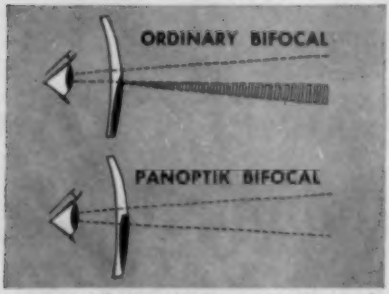

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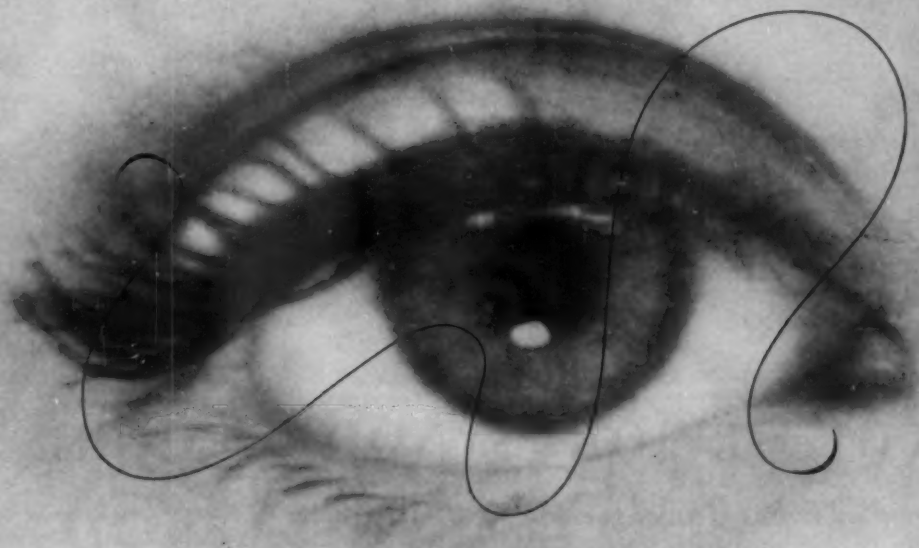

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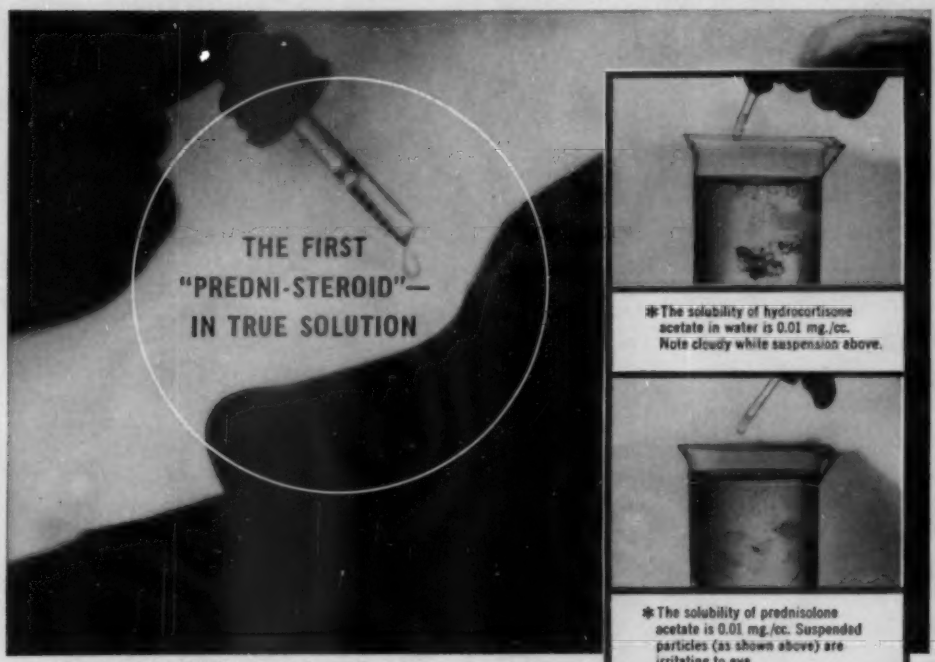

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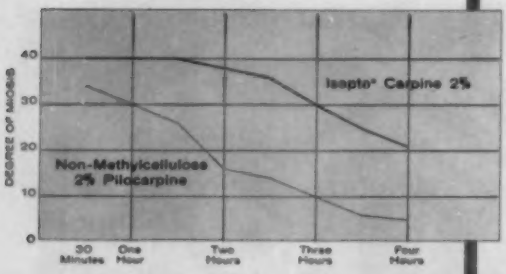

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(Figure 1)
Macular hemorrhage with edema, before treatment

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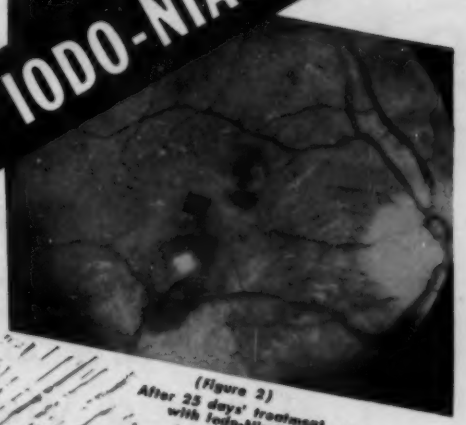

(Figure 2)
After 25 days' treatment with Iodo-Niacin

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1. *Am. J. Ophth.* 42:771, 1956.
2. *Am. J. Digest Dis.* 22:5, 1955.
3. *Med. Times* 84:741, 1956.
4. *Cecil's Textbook of Medicine*, 7th ed., 1947, p. 1598.

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1. Rasgorshek, R. H. and Melntire, W. C.: Am. J. Ophth. 40:34 (July) 1955. • 2. Ehrlich, L. H.: N. Y. State J. Med. 53:3015 (Dec. 15) 1953. • 3. Gettes, B. C.: A.M.A. Arch. Ophth. 51:467 (April) 1954. 4. Council on Pharmacy and Chemistry: J.A.M.A. 158:1523 (Aug. 27) 1955. • 5. Stoltzer, I. H.: Am. J. Ophth. 36:110 (Jan.) 1953.

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 44 NOVEMBER, 1957 NUMBER 5, PART I

ANTERIOR CHAMBER LENSES*

FOR REFRACTIVE CORRECTION OF UNILATERAL APHAKIA

WOLFGANG A. LIEB, M.D., AND DUPONT GUERRY, III, M.D.
Richmond, Virginia

The refractive correction of bilateral and unilateral aphakia and high ametropias frequently results in difficulties which produce discomfort and reduce a patient's capacity for performing accustomed work.

We wish to report on a new method for replacing the human lens by an acrylic lens, placed in the anterior chamber and held in place by small supports fitting in the angle. This procedure is of greatest value in those cases where binocular vision cannot be obtained by means of an ordinary lens or where a contact lens cannot be employed. These difficulties are most pronounced in unilateral aphakia resulting from cataract extraction for such conditions as traumatic cataract, congenital or heterochromic cataract, and so forth, where a difference of image size, produced by the use of conventional lenses, prevents binocular, stereoscopic vision. Different types of contact lenses may give binocular vision, but many patients are either too young to wear them or are unable to do so because of discomfort. Frequently a patient, because of difficulties with a contact lens, will prefer monocularity, little realizing the marked reduction in visual capacity.

The idea of replacing the human lens by an artificial one is not new. Ridley was the first to report on successful operative replacement of cataractous lenses. He carried out an extracapsular cataract extraction, leaving the posterior lens capsule intact. At the same time, he placed an acrylic lens behind the iris diaphragm, supposedly in the same position previously occupied by the physiologic lens. In this technique, the artificial lens was held in place and centered by the vitreous pressure, the posterior lens capsule, and posterior surface of the iris. Unfortunately all too often, as demonstrated by his cases and those of others, this procedure has not produced the desired results. An anterior displacement or a posterior displacement into the vitreous has been a fairly common complication, as has been a severe intractable uveitis. A procedure in which a lens could be placed in the center of the anterior chamber would seem to offer several advantages.

In the years 1953 to 1956, a few continental ophthalmologists, Strampelli, Bietti, Baron, Schreck, Scharf, Dannheim, and others were inspired to develop tiny lenses which they placed in the anterior chamber over the pupil, the lenses being held in place by delicate feet, which rest in the chamber angle. The procedures and models introduced by the different investigators differ mainly in size, form, and material of the artificial lens. It seems difficult at this time to determine who deserves priority for this original idea. It would appear, however, as so often happens in medicine, that several workers conceived the idea at or about the same time, and credit should, therefore, be given all of the pioneers.

Whatever the final results may be after a longer period of observation, at the present

* From the Department of Ophthalmology of The Medical College of Virginia. A report on this work was presented at the conference of the Virginia Institute for Scientific Research, Richmond, Virginia, May 16, 1957.

time this procedure offers probably the best way to improve these disorders which until now have been problem children in ophthalmology. Schreck deserves the honor of having refined and elaborated the method, not only in animal experimentation but also in man. Personally, we are most grateful to Schreck for acquainting us with his operative procedure and results. We have seen a number of his cases with a postoperative course of two years or more. They have retained good visual acuity and showed no inflammatory changes under the slitlamp. In the majority of cases, the intraocular pressure, one of the most important features to be considered, did not show any tendency to permanent elevation. Recently, in a personal communication, Schreck reported to us over 100 successful operations.

Obviously, the implantation and fixation of a foreign body, such as the artificial lens, in the anterior chamber may create doubt in the minds of some ophthalmologists. Therefore, several precautionary factors should be considered.

A. Mechanical factors

1. The main objective is not to impair the aqueous dynamics by causing a tension rise by angle block or reflex stimulation.

2. The central fixation of the implanted lens must be maintained in order to accomplish a permanent and satisfactory optical result.

3. The optical and supportive part of the lens should be made as small as possible in order not to displace too much fluid.

4. The weight of the lens and supporting apparatus should be kept to a minimum in order that the pressure which is applied by the support will not produce atrophy or hyperplasia of the opposing tissue structures.

5. The supporting part should be flexible in order to minimize trauma during the operative procedure. Tissue trauma causing atrophy or hyperplasia secondary to the implanted lens should be decreased in proportion to the flexibility of the supports.

B. Chemical factors

1. The material used for the lens and supports should cause only a minimal degree of irritation in order to avoid explosive or lingering foreign body inflammatory reactions.

2. The selection of the chemical substance used for the lens and supports should be of such a nature as not to disturb the electrolyte balance of the aqueous humor.

We examined these various factors through animal experiments.

Animal experiments

A. Preliminary studies

In order to perform preliminary studies, various experimental animals were used: (1) rabbits, (2) cats, and (3) dogs. It has been shown that, due to anatomic features, the dog eye was best suited to our purposes. First plastic, or better acrylic, strips of various sorts and shapes (Lucite, Plexiglas) were implanted in the anterior chamber of dogs. The diameter of the plastic implants was determined by measuring equatorial sections through the chamber angle of enucleated dog eyes.

It was found that they were increasingly better tolerated in proportion to the decrease in size and weight. It should be noted also that our acrylic implants C and D (fig. 1) were easier to manipulate during the operative procedure and so less traumatizing to the delicate eye tissues, especially Descemet's membrane, the corneoscleral trabecula, Schlemm's canal, and iris, where the supporting structure was of flexible material. The best results were obtained with nylon and Supramid threads. Another finding was that the tolerance was not influenced by the shape of the loop (that is, supports curved and so fitted in the chamber angle, or straight, and thus in contact with the posterior surface of the cornea or anterior lens surface).

Fig. 1 (Lieb and Guerry). Experimental anterior chamber implants of various form and nature (Lieb). (A) Curved right angular plastic strip. (B) Curved right angular plastic strip with parabolic edges. (C) Right angular plastic strip with peripheral, curved polyamidic loops. (D) Right angular plastic strip with straight polyamidic loops.

B. Results of lens implants

The next step was to investigate the results of lens implants in the anterior chamber of dog eyes. In 16 operations, 14 good operative results were obtained. The two other cases were failures due to operative difficulties and infection. In six cases, the "Schreck" lens with solid plexiglas supports was implanted. In two cases, the Dannheim lens with flexible supports was employed; and in six cases, our lens was used as will be mentioned below. In all these cases, the technique described by these investigators was used. The keratome incision was made intracorneally. The lips of the corneal wound were closed at the end of the procedure by using two 6-0 mild chromic catgut sutures. Atropine ointment, penicillin, and systemic and local corticosteroids were applied over a period of 10 days in the postoperative period. It must be stated that in all cases the gross diameter of the lenses with their supportive part was too small for the dog eyes.

In the postoperative period of four to 14 days, the eyes showed moderate congestion and striate keratopathy. After this time, three cases still showed slight clouding at the site of the keratome section. This persisted for about four weeks. All other eyes were quiet with clear media. These animals were observed over a period of six to eight months.

In all of these dog eyes, the crystalline lens had not been removed. It is interesting to note that, during the observation period, neither the crystalline lens nor the artificial lens showed major precipitation or clouding. In some of the experiments, there were some small pigment spots present on the lens during the observation period but never to the extent of causing any major interference with the optical result.

Although we obtained good results, the disproportion between lens and physiologic space made us in the very beginning consider methods of correcting this source of possible failure. The final result of this search was that one of us (Lieb) combined plastic implants C and D shown in Figure 1 with an acrylic lens by fitting the plastic loops of nylon (Dermalon) and Supramid into peripheral grooves of the anterior chamber lens. This modification will be described in detail below. By this method we were able to adapt the diameter of the supportive part exactly to that of the anterior chamber.

This lens was used in six dog eyes, using a technique which will be described later. It appeared to us that the perilimbal congestion and striate keratopathy were considerably decreased and lasted only from three to 10 days. The small pigment spots on the acrylic lens, as described in the former experiments, have also been observed with this new lens under the slitlamp, but again not in sufficient numbers to be disturbing.

Lens, operative instruments, and procedure

In the animal experiment as stated above, the corneal diameter of the normal dog eye did not correspond to the diameter of a commercially obtainable lens from Europe, since they were designed for use in human eyes

only. This discrepancy led us from studies on the preliminary right-angular plastic implant (in which two loops were fitted in peripheral grooves) to combine this form (fig. 1-D) with a small plastic lens. This lens, as modified by Lieb, has a resilient mount for positioning the lens in the anterior chamber of the eye between cornea and iris, the mount being composed of tapering, winglike loops of a thin rod or wire of resilient material secured to the lens and terminating in arcuate end portions with a radius of curvature less than that of the lens itself.

The drawings in Figures 2a and 2b illustrate the features of the lens: (A) is an elevation of the lens and the tapered winglike mount. (B) a sectional view showing the lens of (A) in position in the anterior chamber and with the original lens of the eye removed. (C) is a side elevation of the lens shown in (A). (D) is a side elevation of the lens and partly in section. (E) is a sectional view on the line 5-5 of (A), showing in addition the groove in the lens which receives the retaining mount, illustrated in section in (D). (F) (fig. 2b) is a view similar to (C) but utilizing a converging lens. (G) is an elevation of the lens shown in (F), showing the retaining groove in the lens in cross section. (H) is a view similar to (E) of the converging lens of (F) and (G). (I) is a perspective view of the lens shown in (F), (G), and (H) and the mount. (J) is a view similar to (B) but illustrating a case in which the normal crystalline lens has not been removed. This

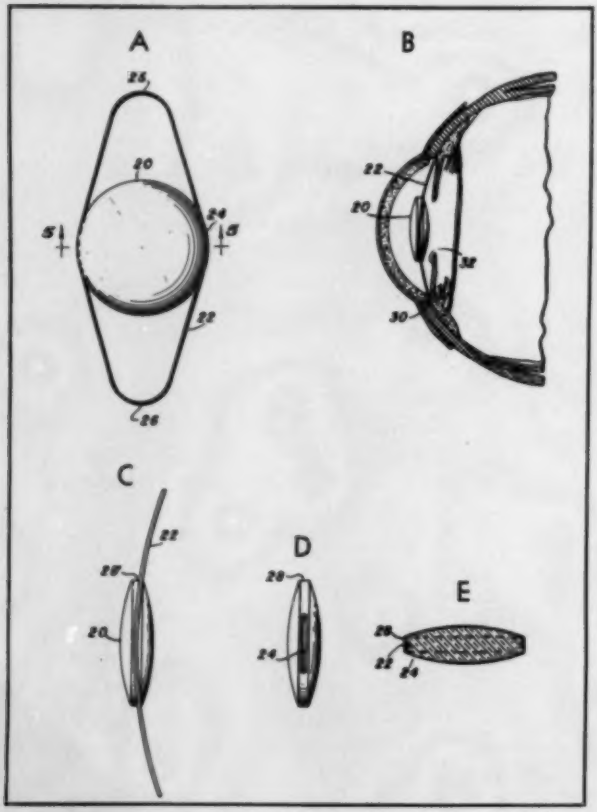


Fig. 2a (Lieb and Guerry). Anterior chamber lens. (See text for explanation.)

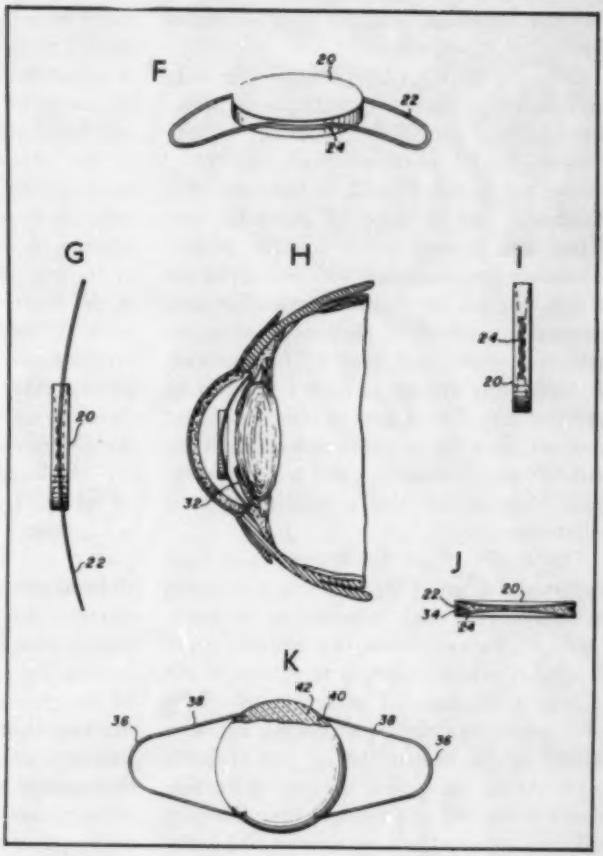


Fig. 2b (Lieb and Guerry). Anterior chamber lens. (See text for explanation.)

would be desirable, in cases of high ametropia and anisometropia. (K) is an alternative form of mounting.

Referring to (A) to (E) (fig. 2a) of the drawings, there is shown a converging type of lens, and in (F) to (H) (fig. 2b) a diverging type of lens, but any suitable type of lens may be used. In our later experiments, we have also employed convex-concave lenses.

The lens should be made of a suitable optical material with the following properties:

1. Suitable refractive index, that is, at least greater than the refractive index of the aqueous humor and preferably at least 1.49.
2. Lightweight and small.
3. Nontoxic and nonirritating to the sensitive fluids and tissues of the eye.
4. Inert, that is, has the required chemical stability and unaffected by the tissues and fluids of the eye, and without affecting same.

Previous experiences in general and ophthalmic surgery have shown that a group of synthetic resins comprising compounds of polycondensation and polymerization are well tolerated by the body tissues and fluids. Suitable optical materials having the aforementioned attributes include polyesters, such as diethylene glycol bis-allyl carbonate resin, polyacrylates and polymethacrylates such as methyl methacrylate resin, optical glass, and so forth. The best material so far developed appears to be methyl methacrylate resin,

available, for example, under the trade marks *Lucite* and *Plexiglas*.

Referring to (C), (D), and (E) (fig. 2a), the lens has at diametrically opposite points peripherally provided grooves. These grooves, No. 24, as shown in (A) and (C), receive the mount, No. 22, in the form of a continuous rod or wire of generally oval shape and formed of a suitable plastic. Important considerations with respect to the mount, No. 22, are that it have the chemical properties required of the lens material, as indicated above, and that it, furthermore, be sufficiently strong to be self-supporting and resilient. The mount material need not, however, have the optical requirements of the lens. Nylon (Dermalon) and a superpolyamide (Supramid) have proven to be most satisfactory.

The resiliency of the mount is a most important feature. When the lens is mounted in the eye, even slight pressure on, or movements of, the eye may induce stresses in the tissues. A prime objective, therefore, is not to impair the aqueous dynamics, especially with respect to a rise in intraocular pressure caused by an obstruction of the chamber angle. At the same time, the central fixation of the implanted lens must be maintained in order to accomplish a permanent and satisfactory optical result. A further requirement is that the lens, and particularly the supports, occupy as small a space as possible in order that only a minimum amount of fluid be displaced. It is also important that the lens be easily inserted into the eye. The generally tapered winglike structure of the resilient rod or wire, illustrated in the drawings with the reduced rounded end portion, is particularly adapted to meet these objectives.

It will be observed that the loops are also shown as having a generally hyperbolic curve when viewed from the side, (see (C), fig. 2a). This curve is advantageous since contact with the iris is avoided, thus reducing the possibility of foreign body irritation. Nevertheless, in our later experiments, we also used lenses with straight loop mounts which were thus in contact with the posterior surface of the cornea, leaving the angle free of any obstructive means. The apparent disadvantage of contact with the iris structure and sometimes the bulging anterior surface of the vitreous did not prove to be substantial. The diameter of the lens together with the supporting apparatus should be so adapted in respect to the anterior chamber of the eye that the loops rest very lightly in the angle or on the posterior surface of the peripheral cornea, thus exerting minimal pressure on the supporting tissues. As a general rule, if curved loops are used, the diameter may be 0.5 to 0.7 mm. greater than the diameter of the cornea; if straight loops are employed, the diameter should correspond exactly to that of the cornea.

In order to affix the mount to the lens, a plastic rod or wire is placed in the peripheral groove, and then the lens and mount material are fused together, for example, fusion with heat or by means of a plastic solvent. In some instances, the construction of the groove can be made such that when the mount is placed in position in it, the lens and rod are securely fixed. We found this method of mounting preferable. Where discontinuous loops were used, the ends were anchored to the lens at peripherally spaced points as shown in (K), Figure 2b. The lens used by us has a diameter of about five mm.

In figuring the adequate dioptric power of the plastic anterior chamber lens, the different indices of the other light-breaking medias of the eye must be considered. The refractive index of the plastic material used for the lens must be greater than that of the aqueous humor which is 1.336. Our material had an index of 1.496.

In order to determine the required dioptric power of the anterior chamber lens, the aphakic spectacle correction, as computed for a cornea-vertex distance of 12 mm., is employed, tables being available for the proper determination of lens power (table 1). This procedure has been simplified by

TABLE 1

EQUIVALENTS OF DIOPTRIC POWER IN AIR FOR EXTERNAL AND ANTERIOR CHAMBER LENSES

External Lenses	Anterior Chamber Lenses
+8.0	+29.0
+9.0	+33.0
+10.0	+37.0
+11.0	+42.0
+12.0	+46.0
+13.0	+51.0
+14.0	+56.0
+15.0	+61.0
+16.0	+66.0
−8.0	−23.0
−9.0	−25.0
−10.0	−28.0
−11.0	−30.0
−12.0	−33.0
−14.0	−37.0
−16.0	−41.0
−18.0	−45.0
−20.0	−49.0

the manufacturing firm* which supplies the lenses in three different diametric lengths of the mounts stored in Zephiran chloride filled containers and labeled with the equivalent spectacle power.

The instruments used for the implantation procedure should fulfill certain criteria. Due to the limited space in the anterior chamber, they must be made as small as possible and, in order to minimize operative trauma, as blunt as possible. In a normal procedure, only two special instruments are needed: (1) a blunt, slightly curved spatula, to cover pupillary space and iris tissue (fig. 3), and (2) the lens fixation forceps which allows in one phase introduction of the lens followed by a turning maneuver which moves the mount away from the keratome incision (fig. 4).

Touching of the iris and corneal endothelium should be assiduously avoided. In order to accomplish this, several instruments were designed, the most recent being shown in Figures 3 and 4. The elegantly curved, tiny tips of the forceps make for ease of introduction and turning in the same movement. Instead of using the forceps, a rubber erisophake can be employed.

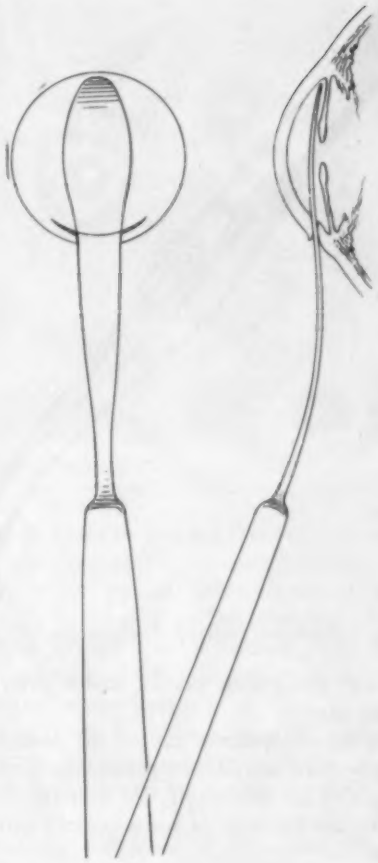


Fig. 3 (Lieb and Guerry). Implantation spatula.

TECHNIQUE OF LENS IMPLANTATION AND POSTOPERATIVE MANAGEMENT

STERILIZATION OF THE LENS

The lenses are stored in small containers in a 0.1-percent Zephiran solution. The evening before operation, the lens of proper dioptric power and with mounts of correct diameter is removed from its container and placed in a solution of normal saline with crystalline penicillin, where it remains until needed at operation. The lens is then rinsed

* Titmus Optical Company, Petersburg, Virginia.

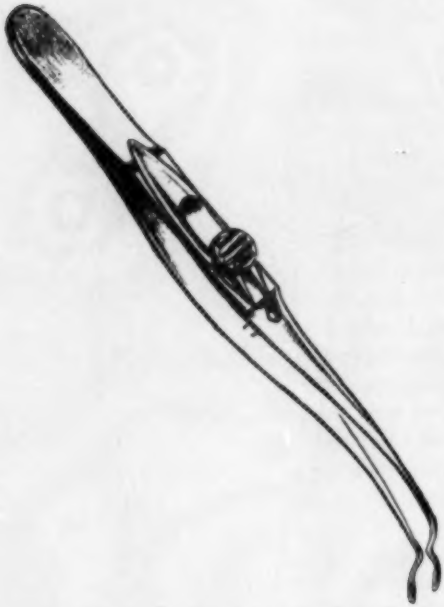


Fig. 4 (Lieb and Guerry). Implantation forceps.

several times with normal saline prior to being used.

In the co-operative patient, the procedure can be done satisfactorily under local anesthesia. The indications for general anesthesia are the same as for a cataract extraction.

Anesthesia

Beginning one and one-half hours before operation, one drop of a four-percent solution of pilocarpine is instilled in the eye every 15 minutes in order to assure a marked miosis. Local anesthesia is obtained by instilling two to three drops of a 0.5-percent solution of pantocaine into the patient's eye four or five times at two to three minute intervals beginning about 15 minutes preoperatively. Akinesia of the lids is carried out by either the Van Lint or O'Brien technique. In cases of a small palpebral fissure, a lateral canthotomy should be done; a retrobulbar injection of 1.5 cc. of two-percent procaine, with hyaluronidase and adrenalin, has proved helpful. After introducing a lid speculum, a bridle suture is placed in the superior rectus tendon.

Operation

An intracorneal limbal keratome incision is then made temporally (that is, the 9-o'clock position in the right eye and the 3-o'clock position in the left eye). The section should be about 0.5 to 0.8 mm. intracorneally. If no peripheral iridectomy has been performed previously, a small root iridectomy is advisable. The anterior chamber lens is grasped peripherally with the lens fixation forceps in an oblique position and laid aside. The blunt implantation spatula is introduced to cover the pupillary area and iris without touching the opposite angle. Then the corneal flap is slightly lifted in order to allow the resilient loop to enter the anterior chamber. The lens is led into the eye by the double-curved fixation forceps in an oblique position. By turning the forceps around the keratome incision, the lens is turned into a vertical or near vertical direction in order to bring the supportive part away from the wound.

By using different lengths of mounts and depending on the presence or absence of a hyperbolic curve within these mounts, the loops either touch the angle tangentially or the posterior surface of the cornea close to Schwalbe's ring. In the first case, lens and mount are completely surrounded by aqueous humor; in the latter, the loops may slightly touch the iris, and the posterior surface of the lens may touch the hyaloid membrane if herniated vitreous is present (as seen after an intracapsular extraction, fig. 5).

In most instances, the corneal wound edges are properly coapted, but one or two intracorneal sutures assure proper apposition.

Postoperative

Atropine and terramycin-polymyxin ointment are placed in the conjunctival sac, and

Figs. 5-A to F (Lieb and Guerry). Shown on pages 587, 588, and 589 are drawings and photographs of the operative technique of lens implantation.

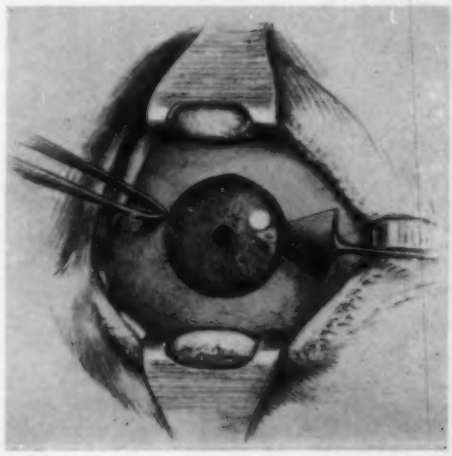


Fig. 5-A. Intracorneal keratome incision.

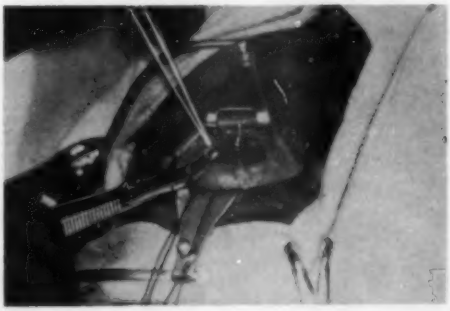
a monocular dressing is applied. A dosage of 500 mg. of Diamox is administered.

Systemic antibiotics are given for the first four or five postoperative days and Metacorten in fairly large doses beginning on the second postoperative day and continuing for one week. Early ambulation (first or second postoperative day) is encouraged, and the patient is usually discharged between the fifth and seventh day.

Results and Discussion

Up until the present time, we have implanted eight anterior chamber lenses of various types in humans. This limited number does not permit statistical analysis nor have these patients been observed long enough to allow a critical appraisal of the results. Despite this, our results have been so encouraging that a discussion of our findings seems justified.

Two cases have been operated with the Schreck type implant, two with the Dannheim implant, and four with our modification (figs. 6; 11 to 15). We have found no significant difference in the results. Therefore, we feel that we can discuss these cases as a group.



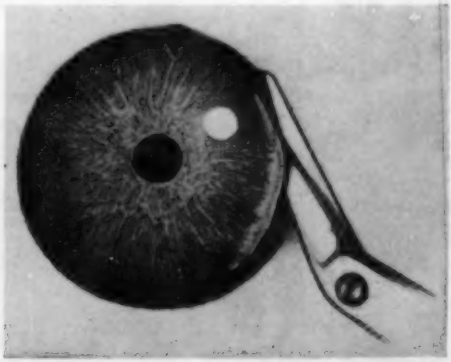
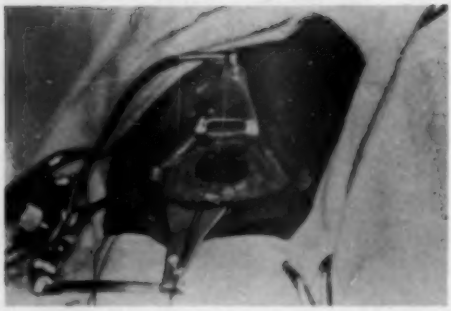


Fig. 5-B. Side enlargement of section.



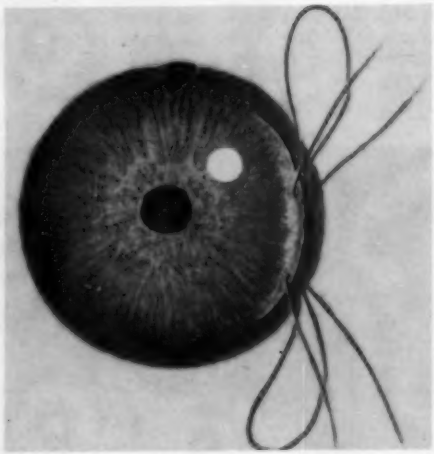


Fig. 5-C. Corneal sutures in place.

Because we realize that this procedure is still relatively new, case selection has been critical. Only patients with unilateral cataracts have been chosen. Most of these were traumatic; the rest, congenital or metabolic. The age distribution was from eight to 54 years. In general we feel trauma and irritation can be minimized by performing the cataract extraction and lens implanation as a two-stage operative procedure. The time-interval between the procedures can be considered adequate when the operated eye quiets down after the first procedure and remains quiet for two to three weeks. About

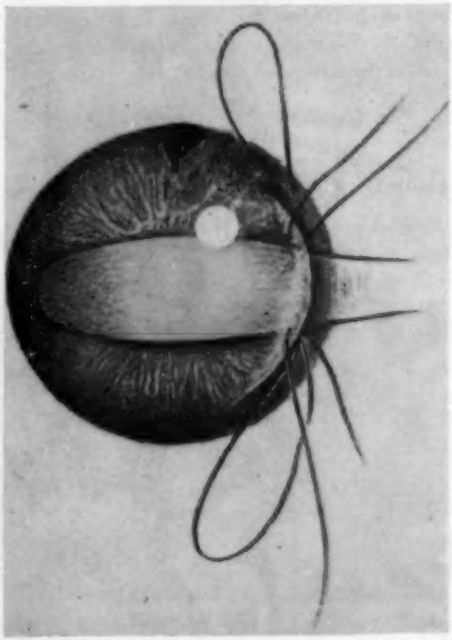


Fig. 5-D. Introduction of implantation spatula.

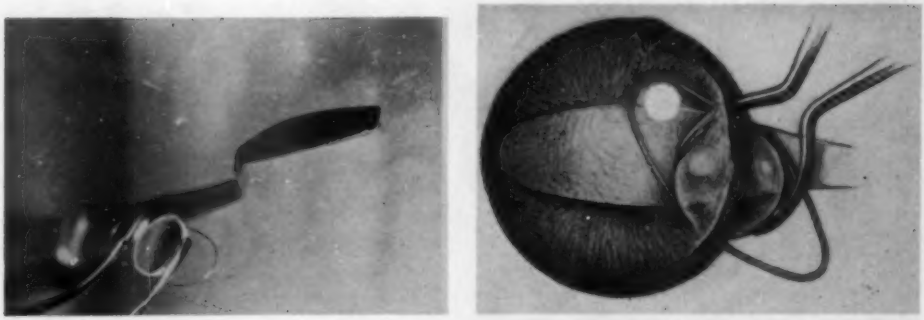


Fig. 5-E. Introduction of lens.

three to eight weeks is usually sufficient. However, there is no time limit to the interval between operations.

We have also performed both operations in a one-step procedure. Here, as might be expected, the postoperative reaction is slightly increased and a little prolonged. At any rate, the two-stage procedure has the distinct advantage of allowing the determination of the exact refractive error of the patient's aphakic eye prior to implanting the lens. If a lens implant is done in a one-stage procedure, the surgeon has to rely on the supposition that the total refraction in the cataractous eye is equivalent to the refraction of the unaffected eye. If an anisometropia has existed, a large error may, therefore, be introduced.

Another point of importance which may influence results is the method of lens extraction, that is, intracapsular or extracapsular. Implants have been done after both procedures. In contrast to the Ridley procedure, which needs the posterior lens capsule to support the lens, the anterior chamber lens can be implanted with the same good result whether the posterior lens capsule is present or not. In cases of extracapsular extractions, a secondary membrane requiring discissions may form; but if the lens implant is already in place, the secondary membrane can be easily incised behind the artificial lens.

In one case, the anterior limiting membrane of the vitreous body was seen to bulge forward through the pupillary space after intracapsular extraction. Such a small vitreous hernia did not interfere with the visual result, although there was direct contact with the posterior surface of the lens implant.

A round pupil is preferable, because the

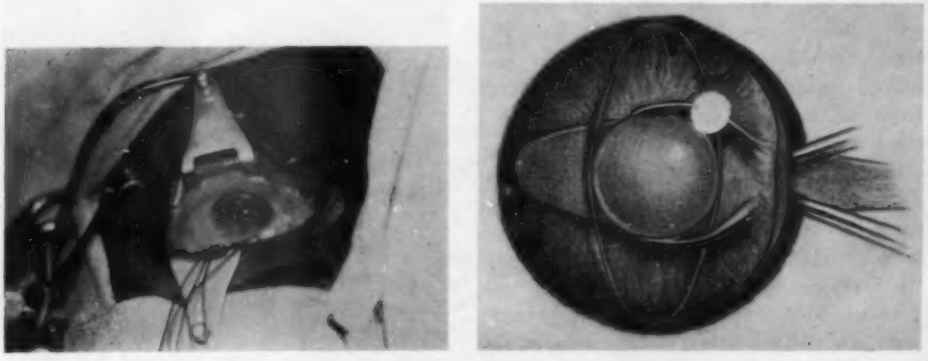


Fig. 5-F. Lens in place.

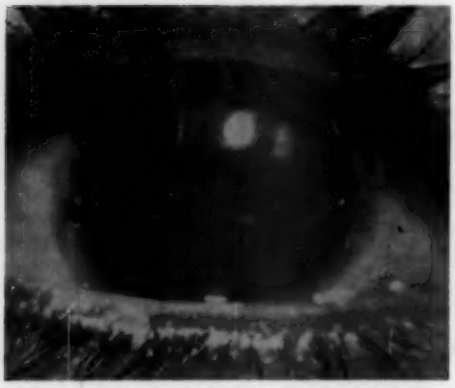


Fig. 6 (Lieb and Guerry). Patient J. W. immediately postoperatively.

implantation is made easier. The lens can also be implanted in cases where a complete iridectomy has been performed. In such instances the supportive loops have only to be positioned perpendicular to the coloboma (fig. 7).

After reviewing the literature, we have found the different lens models of other investigators, namely (see fig. 8), Strampelli (A), (B, C), Apollonio (E), Baron (F), Schreck (G), and Scharf (D), differ primarily in the form of the supportive part or mount. The material appears in all cases the same as the lens. This has the possible advantage that only one foreign material, in these cases, Plexiglas, has to be tolerated by the eye. An undesirable feature may be the presence of supports which are too rigid.

With the idea of reducing any possible tissue pressure on the angle or adjacent tissues, Dannheim (H) and Lieb (I) employed mounts of resilient threads in the form of a double loop, thus providing a more flexible support (figs. 8 and 9). The difference between these two lenses is that Dannheim, by using a biconvex lens in order to make the lens as small as possible, places his threads through the peripheral lens body; whereas, by utilizing a convex-concave lens, Lieb was able to reduce the lens to about the same size and yet mount the supportive loops in peripheral grooves.

The theory that visual interference, especially in direct illumination and bright sunlight, may occur with the Dannheim lens (where the supportive thread is an integral part of the lens body) has not proven to be correct. Lenses with elastic loops as a supportive apparatus, such as those of Dannheim and Lieb, require a smaller keratome incision because of their flexibility, thus facilitating implantation.

The operative technique described by us differs from other investigators' mainly in the utilization of different instruments for the introduction of the lens. Prior to this study, only Schreck and Bietti, in an effort to minimize trauma, have used a blunt spatula to cover iris and pupillary space during the introduction and turning maneuver of the lens (fig. 5). This is especially important in eyes in which an intracapsular extraction has been carried out and in which the vitreous bulges forward. Here the plastic lens may easily injure the anterior hyaloid membrane if this structure is not protected. In other cases where the anterior chamber is shallow or the iris diaphragm is pushed forward, the avoidance of the pupillary space is facilitated by the previous introduction of the blunt implantation spatula.

We, as do most other surgeons, prefer an intracorneal, slightly beveled self-sealing

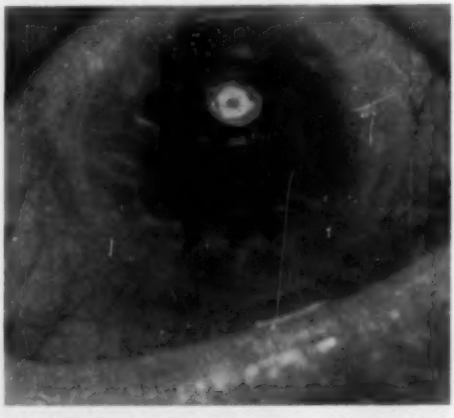


Fig. 7 (Lieb and Guerry). Patient R. C. with anterior chamber lens and total iris coloboma.

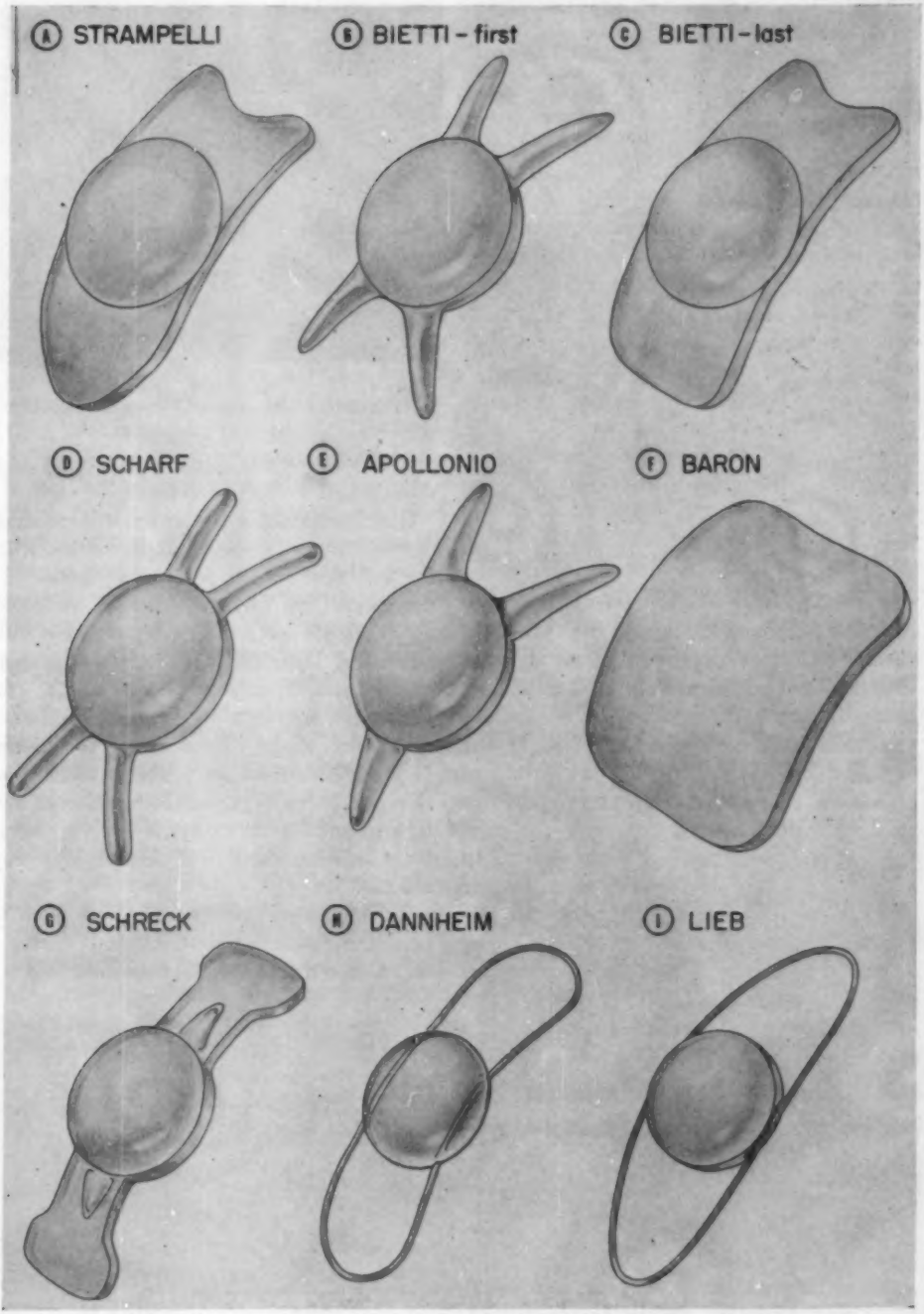


Fig. 8 (Lieb and Guerry). Different models of anterior chamber lenses. (A, B, C) Strampelli, (D) Scharf, (E) Apollonio, (F) Baron, (G) Schreck, (H) Dannheim, (I) Lieb.

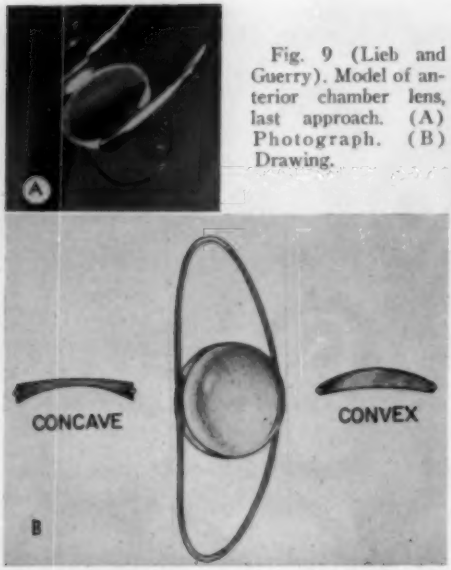


Fig. 9 (Lieb and Guerry). Model of anterior chamber lens, last approach. (A) Photograph. (B) Drawing.

keratome incision, which prevents such postoperative complications as iris prolapse, protusion of a supportive part through the incision, and so forth. With this technique, a postoperative complication of this nature has not yet been observed by us. If the aphakic eye does not show a peripheral coloboma at operation, we prefer to perform a small iridectomy or iridotomy at the completion of the implantation procedure. In our opinion, this may prevent temporary rises of the intraocular pressure immediately postoperatively. In some cases, it was found that the lens, even if it was not completely

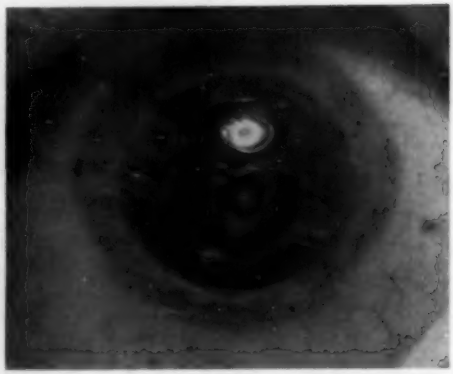


Fig. 11 (Lieb and Guerry). Patient J. B.: Anterior chamber lens in place seven months after operation.

centered or was a little twisted, did not show major refractive errors.

Bietti described a circumscript thickening of the cornea in the area of contact with the lens tips. In our postoperative observation period up to eight months, we could not visualize such changes in cases with Schreck's, Dannheim's, or our modification of the lens. However, in two of the experimental implants in dogs, we found a thickening of the cornea at the site of the keratome incision with slight endothelial changes. In our opinion, these changes can be attributed to an excessive shelving keratome incision, which in these cases was very oblique.

During the immediate postoperative period, slight to moderate reactions were observed in our first cases. These included con-

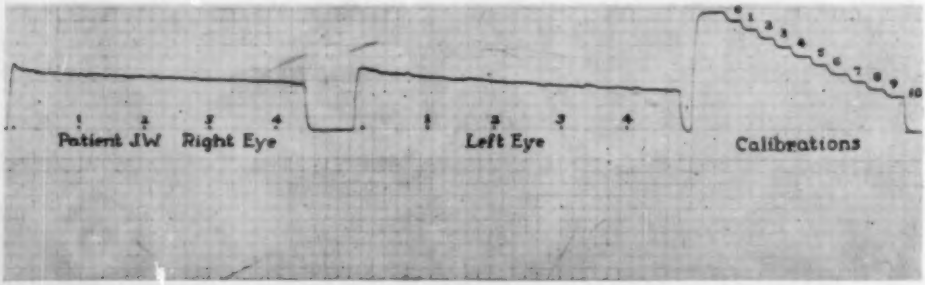


Fig. 10 (Lieb and Guerry). Patient J. W.: Electrotonographic record, three months after anterior chamber lens implantation.

gestion of the conjunctival and ciliary vessels, striate keratopathy, a few cells and flare, and occasionally fibrin in the anterior chamber with few to moderate numbers of pigment spots on the plastic lens. These reactions were usually evident in the first eight postoperative days. In all other cases, we were able to control these reactions almost entirely by the use of corticosteroids (40 mg. metacorten daily starting on the second postoperative day for six days with gradual reduction in dosage in the succeeding four to six days). Any complications such as delayed wound healing, leaking wounds and iris prolapse, or systemic alterations have not been observed.

We would like to quote Schreck, who writes that one should not become immediately disturbed by these postoperative reactions and fear infection, for, in most cases, they rapidly regress and disappear. In his cases he prescribes a combination of antibiotics and milk injections. He sterilizes his plastic lenses with a one-hour bath in one percent Quartamun. However, this material shows a high surface activity and remains firmly fixed to an acrylic lens. He advises, therefore, careful rinsing in order to prevent a reaction caused by this agent. Schreck states that, in general, his eyes show uncomplicated healing and no more injection and anterior chamber changes than are seen after other intraocular operations, as for example, a normal cataract extraction. In contrast to us, in order not to disturb wound healing, he administers cortisone or hydrocortisone ointment to the eye only after the eighth to 10th day; while we, with application of systemic cortisone at the second to third postoperative day, have also not seen any complications of wound healing.

We believe that there are probably advantages on either side. For us, the prevention of any possible postoperative reactions by combined application of corticosteroids and antibiotics has been shown to be entirely satisfactory. In only one case has there been continued irritation of the eye for a period exceeding six weeks. In no instance has it been necessary to remove a lens because of severe reaction.

Somewhat disturbing to us in the beginning were the precipitates which form on the surface of the plastic lenses. It was felt that these might reduce vision. In most cases, however, they dissolve rapidly and almost entirely disappear, and in no instances has acuity been affected. We have two cases where 20/20 vision in a completely quiet eye was attained after four weeks, though the patients still had a moderate number of pigment spots on the surface of the lens. One of these patients stated several months later that, although he was able to see sharp images in the first four postoperative weeks, he felt that there was a slight color disturbance toward the yellow part of the spectrum. This phenomenon disappeared completely as the pigment spots resolved. This 18-year-old young man after four months was back on his basketball team and shooting as well as he had prior to his accident. This, of course, was proof positive that he had regained stereopsis, a fact corroborated by testing with the synoptophore (fig. 12).

These precipitations have been discussed previously. In connection with the Ridley

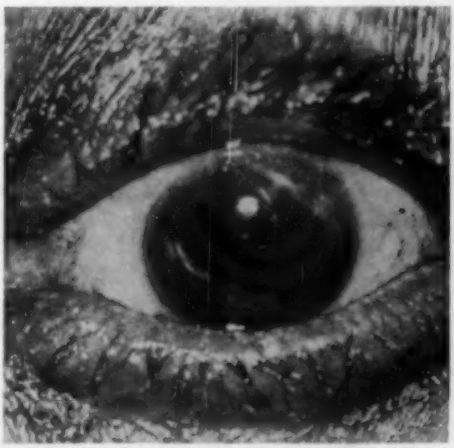


Fig. 12 (Lieb and Guerry). Patient W. L.: Convex-concave anterior chamber lens with peripheral loops five months after operation.

lens, several possible explanations have already been offered. The generally accepted point of view is that they originate in the anterior uvea, as Ridley, Baron, and others propose. On the other hand, Goldmann, Schreck, and others believe them to be condensation products of chemical reactions.

One of our primary objections to the procedure of the implantation of an anterior-chamber lens has been the possibility of a sustained rise in intraocular pressure, a secondary glaucoma. A disturbance of the aqueous dynamics through interference with the outflow mechanism would appear likely. Surprisingly, in the animal experiments, persistent tension rises over an observation period of six months did not occur, although in one animal a temporary rise in intraocular pressure at the second and third postoperative day was observed. This might be explained by the fact that this was the only animal in which we did not perform a peripheral iridotomy or peripheral iridectomy. Even though we believe that this peripheral coloboma is of no permanent importance, in the first postoperative days, such a peripheral iris opening may prevent tension rises due to the postoperative reaction.

Besides this favorable experience, the prevailing view of an intraocular foreign body leading to secondary glaucoma forced us to try implants which, in comparison with the implants with rigid supports, had extensively reduced areas of contact with the angle structures. The use of a resilient mount, which applies less tension to these fragile structures, appeared logical to us (fig. 9).

Gonioscopic examinations show that fear of angle blockage is unwarranted; instead, a more open angle caused by separation of the tissues by the loops results. Three tonographies, performed on dogs under general anesthesia using nembutal sodium (60 mg. per 2.27 kg. body weight) five months after plastic lenses with loop supports were implanted in the right eyes, show the following results, using Friedenwald's 1954 version of the Schiøtz calibration table. In each case, tonography was performed first on the right eye and subsequently on the left eye.

1. Right eye:	$Po = 15.91$,	$Pt_{av} = 27.43$,	$C = 0.27$,	$F = 1.14$
Left eye:	$Po = 14.64$,	$Pt_{av} = 25.99$,	$C = 0.26$,	$F = 0.76$
2. Right eye:	$Po = 14.64$,	$Pt_{av} = 26.78$,	$C = 0.24$,	$F = 0.71$
Left eye:	$Po = 14.05$,	$Pt_{av} = 25.62$,	$C = 0.28$,	$F = 0.66$
3. Right eye:	$Po = 18.05$,	$Pt_{av} = 28.31$,	$C = 0.31$,	$F = 1.97$
Left eye:	$Po = 14.05$,	$Pt_{av} = 25.13$,	$C = 0.37$,	$F = 0.87$

Although the electronic tonometer and table used were not calibrated for dog eyes, these studies indicate that a major interference with aqueous dynamics has not taken place considering the relationship between values found in the implanted eye and the normal eye.

In patients, we found in only one case of round pupil aphakia a temporary rise in intraocular pressure. This was in the case of the 10-year-old boy, R. A., whose secondary membrane had been needled prior to implantation of the lens. In a second-step procedure, a plastic lens of the Schreck type was introduced. The operation was so successful that, at that time, no need was seen to perform a peripheral iridectomy.

At the second and third postoperative days, the young patient showed a slight corneal edema and increased pressure to fingers. Nevertheless, by the fourth postoperative day, the intraocular pressure became normal and has remained so. In all other cases, no increased pressure or corneal edema were noticed in the first postoperative days.

Repeated pressure controls with the Schiøtz tonometer starting nine days postoperatively revealed no significant difference

between the normal, unoperated eyes and the aphakic eyes after lens implantation for an observation period up to eight months.

Tonographic studies with the Mueller Electro-tonometer and a Sanborn Twin-Viso recording unit revealed also no significant changes in the eyes after plastic anterior chamber lens implantation.

The following tonographic record demonstrates the pressure relation between the unoperated normal left eye and the operated right eye in which an anterior chamber lens is in place. This tonographic record was obtained three months after operation (fig. 10).

The gonioscopic examinations with the Goldmann contact glass revealed an open angle with the exception of that area in which the Plexiglas feet of the Schreck lens had their support in the angle. But, even here, it appeared to us more a tissue separation rather than a blockade. With the Dannheim and Lieb type lenses, with their plastic loop mounts, the angle remains open, and in some instances, the mount was found to rest not in the angle itself but against Schwalbe's ring.

In the relationship of the lens to the neighboring iris tissue, anterior limiting membrane of the vitreous, and the posterior lens capsule, the following findings were noted. Normally the lens implant is found to maintain contact with neither the pupillary border of the iris nor the anterior surface of the vitreous.

In one case in which the lens has been tolerated exceedingly well in the anterior chamber for seven months, a very tiny synechia was present between the iris and one of the resilient plastic loops. The cause of this was most likely that the pupil was dilated with one of the mydriatics only after the second postoperative day, rather than immediately after lens implantation. This tiny adhesion is of no pathologic significance.

The importance of immediate postoperative mydriasis should be emphasized. In one other case in which, after intracapsular cataract extraction, the vitreous bulged slightly forward through the pupillary space, a partial adhesion between the anterior limiting membrane of the vitreous and the posterior surface of the plastic anterior chamber lens was found to be present without causing any recognizable pathologic effect.

Another complication observed by Bietti in one of his series of 10 cases deserves mentioning. Here a pupillary block occurred, the lenticulus being too flat. The increased intraocular pressure was normalized by a Fuchs' transfixion of the bulging iris.

The question if such an intraocular plastic implant is well tolerated for an unlimited time is still unsettled. Bietti, in 1953, reports one case where the lens was well tolerated over a period of 16 months. Schreck has a group of 12 cases which were operated two and a half to three years ago. These patients still have excellent tolerance and undecreased visual acuity.

At the present time, our visual results have been encouraging. In most patients, the visual acuity ranges between 20/20 and 20/40 without additional correction. The spectacle lens correction has not exceeded $\pm$1.5D. sph. and $\pm$1.0D. cyl. and in each instance the vision was correctible to the preoperative level obtained with a conventional lens. The selection of the anterior chamber lens with the exactly adapted refractive power appears to us essential. In our earlier cases, we found sometimes that the supporting loops were too short on one side and too long on the other, in such a fashion as to prevent proper centering of the lens. This as well as minor tilting, surprisingly enough, did not produce any refractive error outside the above-mentioned range.

In those cases with 20/20 vision, full stereoscopic vision was restored. To achieve this phenomenon, a postoperative period of about five to 10 weeks appeared to be essential. The tests were performed with the Worth four-dot test, the Synoptophore, and Hering's test.

Schreck reported on a case in which a

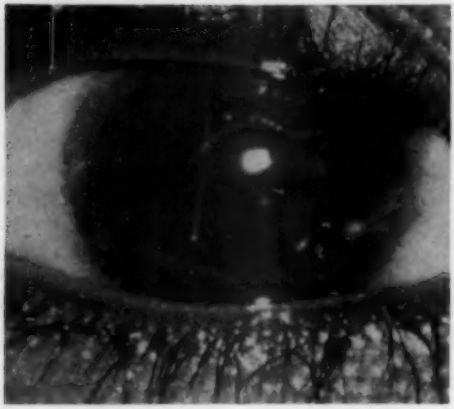


Fig. 13 (Lieb and Guerry). Patient T. M.: Anterior chamber lens in place four months after operation.

divergent strabismus was treated with orthoptic exercises without muscle surgery. We made similar observations in two boys, 10 and 15 years of age, in whom, after the occurrence of a traumatic cataract, an exotropia of 18 degrees and 15 degrees was observed. Within the first few days after lens implantation, the previously divergent eye returned to its proper position even though we had the impression that the operated eye could not possibly have been fully functioning so shortly after the procedure. Orthoptic training and home exercises then resulted in stereoscopic vision after eight to 10 weeks (figs. 13 and 14).

Unlike the restricted visual fields noted in aphakics corrected with conventional lenses, no peripheral constriction of visual fields was noted in the lens implant cases.

Fig. 14 (Lieb and Guerry). Patient J. W.: Anterior chamber lens in place eight months after operation.

Fig. 15 (Lieb and Guerry). Patient N. J.: Close-up of eye with lens in place eight months after operation.

The question of the advisability of replacing a cataractous lens with an anterior chamber lens is still moot and will not be answered finally until a large series of cases, with follow-up periods of at least five years, is available. It would seem, however, that the anterior chamber lens is superior to the Ridley type implant for the following reasons: it is less traumatizing and better supported; if a secondary cataract develops discission is simpler; should removal become necessary, this is an easy procedure.

A final word of caution against indiscriminate use of anterior chamber lenses seems in order. The procedure is still in the experimental stage, and, consequently, proper indications for the implantation of the lens should be strictly adhered to, that is, unilateral traumatic, metabolic, and congenital cataracts (and perhaps excessive ametropia), where binocularity and stereopsis are desirable and can only be achieved or restored by this means. It is also our feeling that a delay of from two to three months after cataract surgery is advisable. If these safeguards are observed, further studies seem justified.

Summary

A method of correcting bilateral and unilateral traumatic, congenital, or metabolic cataracts and high ametropias by implanta-

tion of plastic anterior chamber lenses has been reported. The literature on this subject is reviewed. A complete description of a new anterior chamber lens, operative technique, animal experiments, and patient results with case demonstrations is given.

We would like to re-emphasize that this procedure, though highly successful in selected cases with short-term follow-ups, is still in the research stage, and therefore we strongly caution against the indiscriminate use of the anterior chamber lens.

Medical College of Virginia (19).

ACKNOWLEDGMENT

We gratefully acknowledge the discussion of our work at the ninth annual Clinical Conference of the Wills Eye Hospital in Philadelphia, February 8, 1957, by Dr. Robert Brown of Greenville, South Carolina, and the technical assistance of Mr. L. J. Ellis, Jr., B.S., during the development of the lens.

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STUDIES OF IMMUNITY WITH INTERLAMELLAR CORNEAL HOMOGRAFTS IN RABBITS*

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Donor-recipient reactions occurring in corneal grafts at about the third postoperative week are thought to be due to the combination of donor tissue antigen with host antibody. Tudor Thomas[1] mentioned that "such a reaction may be obtained in two out of five animals when extracts of homologous corneal tissue are injected into the cornea. This does not occur when autogenous extracts are injected."

The importance of the sensitivity reaction in corneal graft opacification has been demonstrated by Billingham and Boswell.[2] In their experiments, a rapid breakdown of homologous corneal epithelium occurred when transplanted into an animal previously immunized by a skin graft from the same individual. Maumenee[3] showed that when skin from the same donor was grafted subcutaneously two weeks after a full-thickness keratoplasty, using only eyes with clear grafts, the transplants became cloudy within two or three weeks in 28 out of 30 eyes.

Klima[4] used corneal extracts in the study of these reactions and showed that two intracorneal injections of the extract from one animal, two weeks apart, gave rise to a reaction, but this seldom occurred if the two injections were from different donors.

Simultaneous intravenous injection of two antigens has been shown by Abramoff and Wolfe[5] to result in a less violent response than that following injection of a single antigen. These workers stressed the importance of the time factor, since the individual antibody responses from a combined preparation may reach their maximum values at different times, and the duration of the immunity may be different.

The importance of vascularization in the production of these reactions was demonstrated by Medawar,[6] who found that skin homografts transplanted into the anterior chamber of the eye of specifically immunized

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rabbits were destroyed only if they became invaded by the blood vessels.

It was the purpose of the present experiments to re-evaluate the immune responses in the cornea following grafting with homologous and heterologous donor tissue. The interlamellar method was used since it has the advantage of being simple to perform and is followed by a minimal postoperative reaction. Billingham and Boswell[2] used this method to study immune reactions with minute skin grafts. In previous experiments,[7] we have shown that 30 percent of interlamellar homografts in rabbits gave rise to immunologic reactions, and that 10 percent of the grafts became permanently opaque.

Procedure

Full-grown rabbits weighing from 2.5 to 4.0 kg. from mixed stock were used. All operative procedures were carried out under intravenous Nembutal anesthesia and full surgical asepsis.

In the performance of the interlamellar graft, a transverse incision 5.0 mm. long and 0.25 mm. deep was made with a fine scalpel blade slightly on the scleral side of the limbus. In the left eye this incision was two mm. anterior to the insertion of the superior rectus muscle and in the right eye it was two mm. posterior to the insertion. The cornea was split with a Tooke knife to make an interlamellar pocket sufficiently large to hold a corneal graft 5.0 mm. in diameter. A fresh, full-thickness corneal graft was cut with a 5.0 mm. Franceschetti's trephine and inserted into the pocket. Care was taken to spread the graft uniformly and to see that no part of it lay outside the pocket. Antibiotic ointments were used routinely after the operation.

Fig. 2 (Basu and Ormsby). Donor-recipient reaction. Simultaneous cornea and skin grafts.

In taking the skin graft, the abdominal wall of the donor was shaved, cleaned, and marked off in 2.5-mm. squares. Full-thickness pieces of this size were excised and introduced into flap pockets of the recipient's belly at the level of the panniculus carnosus muscle on each side of the midline. The incision was closed with a silk stitch. The site of the operation was irrigated with penicillin solution and 100,000 units of penicillin were

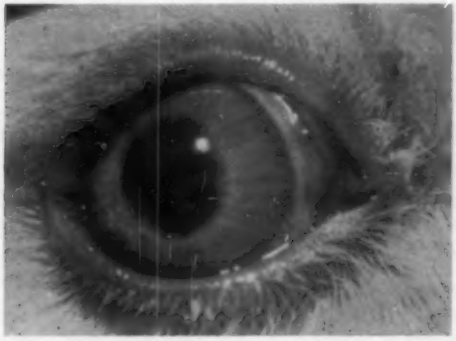

Fig. 1 (Basu and Ormsby). Clear interlamellar graft.

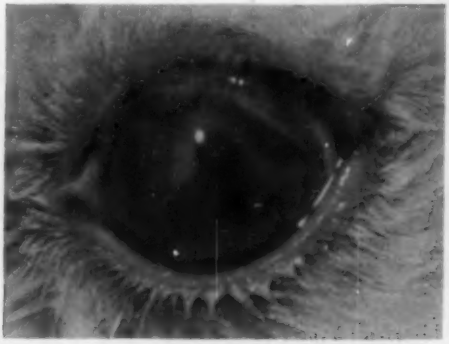

Fig. 3 (Basu and Ormsby). Permanent opacity in an interlamellar graft following donor-recipient reaction. Simultaneous cornea and skin grafts.

injected intramuscularly immediately postoperatively and daily for three days.

Results

Observation of the postoperative vascularization in the interlamellar corneal grafts revealed that blood vessels could be divided clinically into a primary group and a secondary group.

The primary group of blood vessels developed in consequence of operative trauma. These vessels confined themselves to the site of operation and rarely invaded the graft itself. They gradually receded and could not be seen clinically with naked eye examination after 10 or 12 postoperative days.

The secondary blood vessels resulting from the immunologic reaction appeared later, with sudden onset, in an otherwise quiet eye. They were progressive in nature and extended beyond the limits of the primary vascularization. They were more superficial than the primary vessels and seemed to invade the graft independently from the limbus. No reactions were seen in eyes which failed to develop primary vascularization. The intensity and extensity of the secondary vascularization seemed directly related to the degree of graft opacification. Topical cortisone reduced the formation of secondary blood vessels and resulted in a higher percentage of clear grafts. When secondary vascularization was increased by artificial means, the percentage of the clear grafts was lowered.

The opacity was evidenced first at the site of the advancing margin of the invading vessels. Those opacities, which were temporary in nature, were probably due to exudation from dilated blood vessels and capillary buds, or to small areas of tissue necrosis which were soon replaced by normal tissues. Permanent opacities were due to invasion by more cellular structures.

In the first series of experiments, a study was made of the effect of the time of skin grafting in relation to the time of corneal grafting upon the percentage and severity of reactions in corneal grafts. In one group of animals, skin and cornea from the same donor were grafted simultaneously. In a second group, skin grafting preceded keratoplasty by three weeks. In the third group, skin grafting followed keratoplasty by three weeks. An equal number of bilateral keratoplasties were carried out using related cornea and skin from one donor on one side, and related cornea and skin from another donor on the other side. These results are seen in Table 1.

It will be seen in Table 1 that the maximum number of reactions occurred in cases where cornea and skin were grafted simultaneously, and the least when skin grafting

TABLE 1

Effect of the time of skin grafting upon corneal graft opacification

	Unilateral Operation	Bilateral Operation
	Skin and cornea from the same donor (related tissues)	Skin and cornea from one donor on one side (related tissues) and skin and cornea from another donor on the other side (related tissues)
	Percentage of opacification	Percentage of opacification (in each eye)
1. Simultaneous corneal and skin grafting	80	70
2. Corneal graft preceded by skin graft by three weeks	75	66.6
3. Corneal graft followed by skin graft by three weeks	60	55

TABLE 2

DONOR RECIPIENT REACTION IN INTERLAMELLAR GRAFTS

Design of Operation		Percentage of Opacities following Donor-Recipient Reaction (in each eye)		
Unilateral Grafting	Bilateral Grafting	Total	Temporary	Permanent
1. Cornea from one donor (no skin grafting)		30	20	10
2.	Cornea from two donors (no skin grafting)	25 25	13 13	8 8
3. Cornea and skin from same donor (related tissues)		80	53	27
4. Cornea and skin from two donors (unrelated tissues)		35	23	12
5.	Cornea and skin from one donor on one side (related tissues) and cornea and skin from another donor on the other side (related tissues)	70 70	48 48	22 22
6.	Cornea and skin from one donor on one side (related tissues) and cornea from another donor on the other side (unrelated to skin)	70 35	48 23	22 12
7.	Cornea and skin from one donor on one side (related tissues) and cornea from the same donor on the other side (related tissues)	70 70	48 48	22 22

followed corneal grafting. In the subsequent experiments, therefore, simultaneous cornea and skin grafting was performed and the results have been presented in Table 2.

It will be seen from Table 2 that in both unilateral and bilateral keratoplasties, when no skin grafts were used, the percentage of reactions was about half that when simultaneous related skin grafts were used. Since the frequency of reaction in unilateral cases was 10 percent higher than in bilateral cases, the effect of simultaneous bilateral grafting was to suppress rather than augment the reaction. When grafting was done using cornea and skin from unrelated donors, the percentage of reaction was only slightly higher than when corneal grafting without simultaneous skin grafting was performed.

DISCUSSION

In these experiments, the corneal homograft reaction occurred two and one-third times more frequently when skin was transplanted from the same donor at the time of keratoplasty. The importance of the sensitivity reaction in the production of corneal graft reactions is thereby confirmed, and these results are in agreement with those of Billingham and Boswell,[2] and of Maumenee.[3]

The interlamellar technique offered a number of advantages over the penetrating method of keratoplasty in the study of these reactions. The almost constant degree of vascularization in the bed of the interlamellar graft, and the rarity of postoperative complications of a surgical nature, made comparative studies and statistical analysis easier than in studies with full-thickness grafts.

While there was an almost constant degree of vascularization in the interlamellar grafts, a small number showed minimal or no vascularization. In these, the homograft reaction seldom appeared. In those grafts

which showed the heaviest primary postoperative vascularization, the graft clouding occurred more frequently. The role of the primary vessels in the etiology of the homograft reaction must therefore be of considerable importance.

In our experiments, the largest number of reactions occurred when cornea and skin were transplanted simultaneously, the reactions were less frequent when skin grafting preceded keratoplasty by three weeks, and even less frequent when skin grafting followed keratoplasty.

When bilateral operations were performed, the reactions were less frequent than in unilateral operations. This phenomenon, referred to by Michaelis as "Konhurrenz der Antigene" (competition of antigen), has been shown experimentally in other ways, notably by Abramoff and Wolfe,[5] who demonstrated that the injection of two antigens into a chicken resulted in a response which was less active than when only one antigen was used.

Summary and Conclusions

1. The interlamellar method of corneal grafting was used in a study of antigen-antibody reactions.

2. A primary group of blood vessels invaded the graft bed following surgery and were essential for the subsequent development of the typical reaction. A secondary group of blood vessels, more superficial than the first, developed at the time of the reaction, and invaded the graft.

3. Reactions occurred in 30 percent of eyes grafted with donor cornea from the same species. With simultaneous grafting of related skin, reactions occurred in 80 percent of eyes.

4. Reactions were less frequent (75 percent) when skin grafting preceded corneal grafting, and least frequent (60 percent) when skin grafting followed corneal grafting.

5. Bilateral operations somewhat reduced the frequency of reactions both in bilateral unrelated corneal grafts without skin grafts, and in the case of bilateral related cornea and skin grafting on one side with related cornea and skin from another host, on the other side.

Banting Institute (5).

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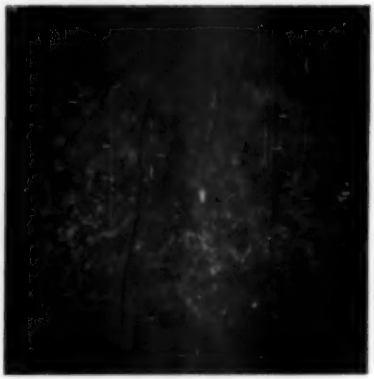

Fig. 7. Severe case, showing pigmentation.

Fig. 8. Moderately severe case, showing pigmentation.

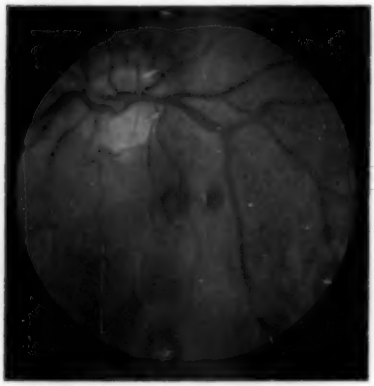

Fig. 9. Mild case, showing pigmentation.

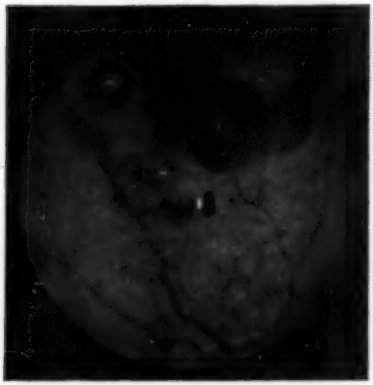

Fig. 10. Severe case, showing atrophy.

TOXIC CHORIORETINOPATHY FOLLOWING THE USE OF NP 207*

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Since chlorpromazine hydrochloride (Thorazine) has proved so successful as a tranquilizer, a continuous search has been made of phenothiazine derivatives to find one that would be as effective as chlorpromazine without its harmful side effects. In the summer of 1955,Sandoz Pharmaceutical released such a preparation to a few places for experimental use. There were only three clinics in the United States that received the drug, and one of these was the psychiatric clinic at Jefferson Davis Hospital, Houston, Texas. The others were the Mayo Clinic and the New York State Psychiatric Institute. The Mayo Clinic[1] reports no visual disturbances in 250 patients treated with a daily dose of 400 mg. Dr. Paul H. Hoch[2] expects to report the one case with visual disturbance occurring at the New York State Psychiatric Institute. This patient received up to 1,000 mg. of the drug daily for a short period. Dr. Vernon Kinross-Wright supervised the study of the effects of the drug at Jefferson Davis Hospital, and he has written a paper describing the pharmacologic actions, as well as effects on the mental and physical status of the patients treated[3]. It suffices here for us to say that NP 207 has a substituted N-methyl piperidine ring (fig. 1); that it is free from some of the undesirable side effects, such as allergic reactions, parkinsonism, and disturbances of the liver, that are prone to occur with chlorpromazine; and that the tranquilizing effects are about equal.

Thirty-four patients were given the drug, and the dosage varied with the mental state of the patient and with its effect as a tranquilizer. Some of the patients received a large amount of the drug over several weeks' time, others a small amount and for shorter periods. As soon as the harmful effects of the drug on vision became apparent, its use was discontinued, but the patients have been followed as carefully as possible in regard to visual effect.

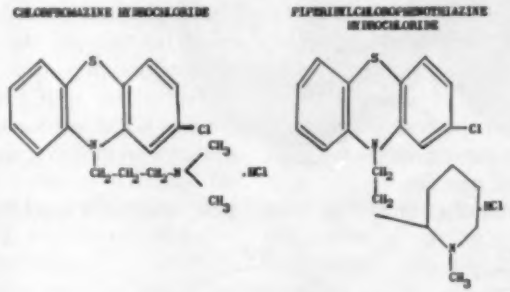


Fig. 1 (Goar and Fletcher). Formulas for Thorazine and NP 207.

Of the 34 cases treated, 28 had some sign of retinopathy. We have classified these cases, somewhat arbitrarily, as follows: (1) severe: visual acuity 20/200 or below, with extreme loss of visual field; (2) moderately severe: retained macular function, but with night blindness, blurred vision, and considerable field loss; (3) mild: no complaints or slight blurring of vision, some field loss, mild pigment changes, and complete recovery (fig. 2). This graph illustrates the number in each classification, the time of

* From the Department of Ophthalmology, Baylor University of Medicine. Presented at the 92nd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1956.

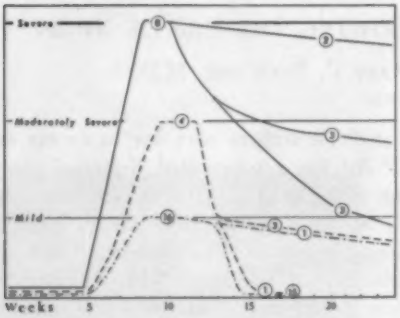


Fig. 2 (Goar and Fletcher). Toxic retinopathy in 28 cases.

Fig. 3 (Goar and Fletcher). Early evidences of toxic retinopathy.

onset, the rapidity of progress, and the degree of recovery. It will be noted that there are eight severe, four moderately severe, and 16 mild cases. The onset in the severe cases was about four weeks after the drug was started; in the moderately severe and mild cases it was about five weeks. All cases reached the peak of intensity from eight to 10 weeks after the drug was started, following which improvement began and continued for several months.

The first suspicion that the drug was affecting the eye was when the junior author was called to the psychiatric ward to examine a patient who claimed she could not see. Upon examination, nothing was found to account for this, and the diagnosis of hysterical blindness was made. This was later concurred in by staff members. Soon other patients began to complain of loss of vision, so that it seemed that an epidemic of hysterical blindness occurred in the ward. At this time word was received from Switzerland[4]

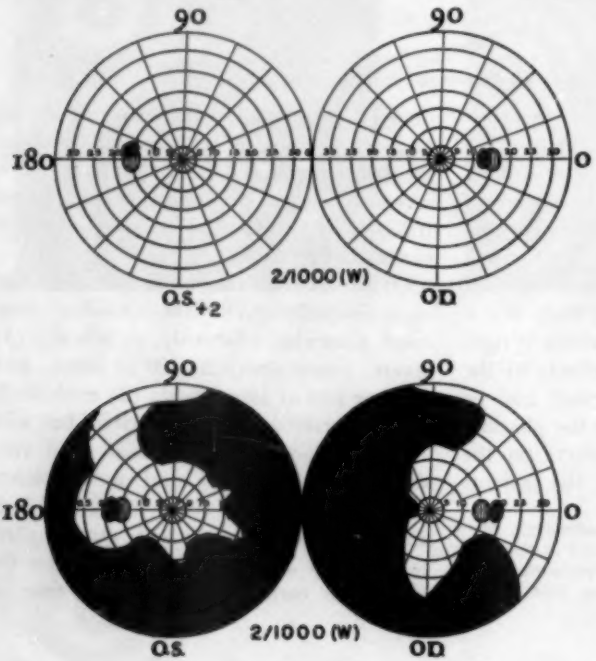
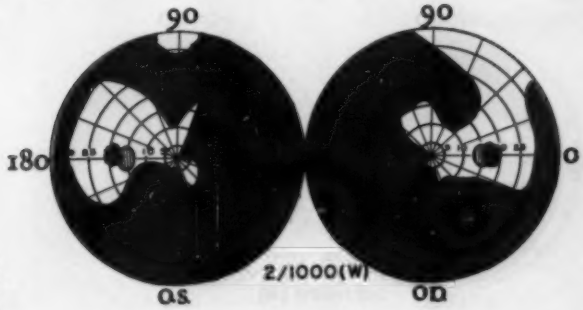


Fig. 4 (Goar and Fletcher). Mild case. (Above) At six weeks; visual acuity, 20/30+2, O.U.; fundi normal. (Below) At eight weeks; visual acuity, 20/20, O.S., 20/40, O.D.; peppery pigment.



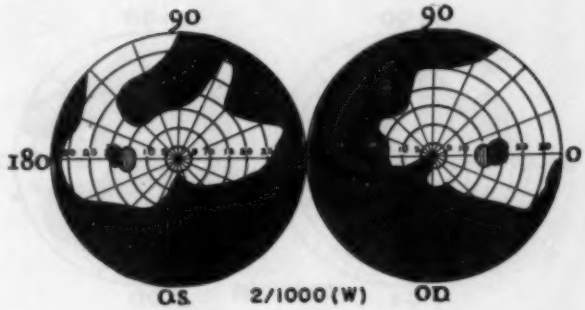


Fig. 5 (Goar and Fletcher). Mild case. (Above) At nine weeks; visual acuity, 20/30, O.S., 20/50, O.D.; marked large peppery deposits. (Below) At 10 weeks; visual acuity, 20/20—2, O.S., 20/30+2, O.D.; marked peppery fundus and some amorphous deposits.

that visual disturbances had been encountered in users of the drug, so its use was discontinued with our patients.

The first symptoms of toxicity were night blindness, loss of color sense, and blurred vision in daylight, followed within a week or two, in the severe cases, by inability to read, or to distinguish colors or objects at a few feet. The mild cases either complained of slight blurring of vision, or made no complaint.

The first signs noted were hyperemia of the optic disc, engorgement of the retinal arteries and veins, and an increase in shot silk reflexes from the retina. Within two or three weeks, fine pepperlike pigment spots appeared in the retina about midway between the disc and the equator. Constriction of the visual fields and scotomatous areas could be demonstrated with the onset of visual symptoms before these fundus changes became apparent. The mild cases gradually recovered their field loss, the dilated arteries became normal or slightly constricted, and the redness of the disc and the abnormal retinal reflexes disappeared. Somewhat later

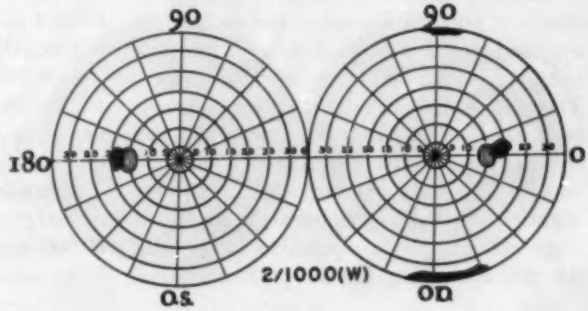


Fig. 6(Goar and Fletcher). Mild case. At 13 weeks; visual acuity, 20/20, O.U.; large peppery and small precipitates throughout.

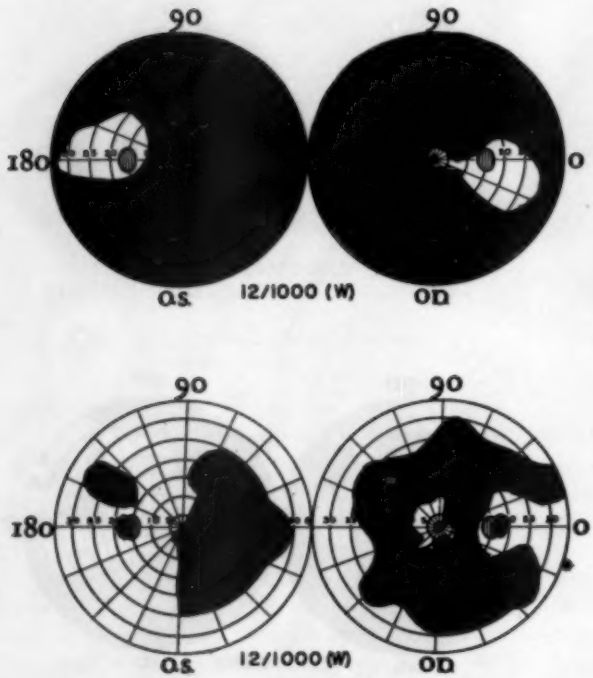


Fig. 11 (Goar and Fletcher). Severe case, showing recovery. (Above) At eight weeks; visual acuity, 20/100, O.S., 20/200, O.D.; amorphous pigment with precipitates in periphery. (Below) At 12 weeks; visual acuity 20/100, O.U.; marked amorphous pigment.

the dilated veins returned to normal. In some cases the pepperlike pigmentation disappeared; in others it has remained after eight months.

The more severe cases had a continuing increase of signs and symptoms, and eight patients became practically blind. Meanwhile the pepperlike pigment areas increased in size, coalesced to form large amorphous pigment clumps, and spread toward macula and disc. A fine haze appeared in the vitreous at this time, and few small opacities, probably pigment clumps, were occasionally seen. In seven of the eight cases, sheets of pigment formed in the midperiphery, and in the late stage this is the chief ophthalmoscopic evidence of the disease. These pigment sheets usually were arranged in a peculiar palisade formation, like the spokes of a wheel between which the pink choroid shone through. In others, large irregularly circular pigmented areas appeared. Pigmentation rarely approached the disc margin, accounting for the preservation of an area of peripapillary vision. In three cases, bare sclera was visible between the patches.

There was surprisingly little evidence of inflammation at any time during the progress of the disease. Three of the patients had small flame-shaped hemorrhages in the 12th, 24th, and 28th weeks respectively. White spots in the macula were seen in four patients, six to 16 weeks after the appearance of retinopathy, but they soon disappeared.

The daily dose of the drug varied from 200 mg. to 2,800 mg., depending upon the amount needed to keep the patient quiet and relaxed. All of the patients with severe retinopathy received in excess of 800 mg. daily for a week or longer. It appears that the size of the daily dosage is more important than the total dosage in producing retinal changes. The smallest total dose given was 900 mg.; the largest 56,000 mg. with an average of 20,000 mg.

As soon as we were aware of the deleteri-

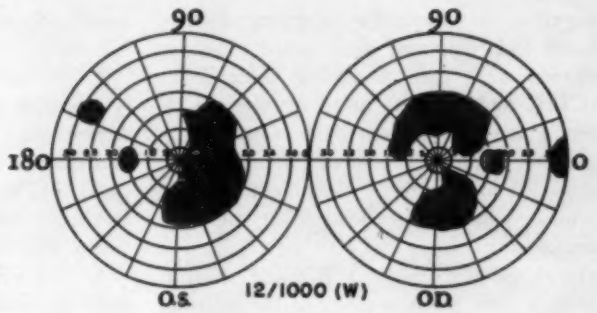
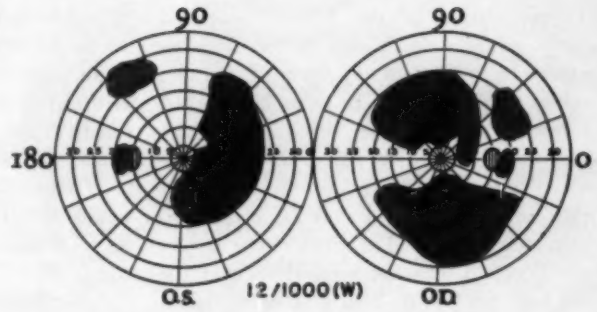


Fig. 12 (Goar and Fletcher). Severe case, showing recovery and regression. (Above) At 15 weeks; visual acuity, 20/40, O.U.; amorphous pigment with many precipitates. (Below) At 28 weeks; visual acuity, 20/50, O.S., 20/40, O.D.; marked precipitated pigment.



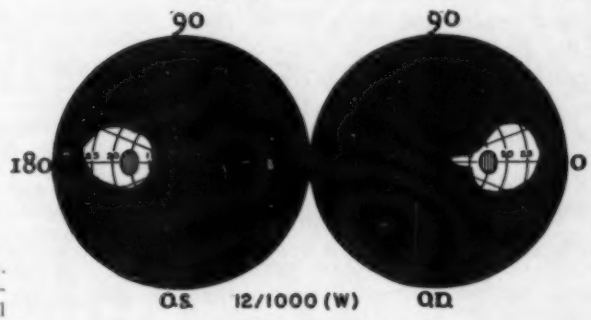
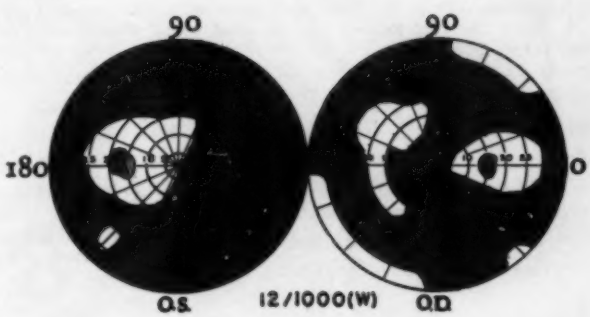


Fig. 13 (Goar and Fletcher). Severe case, showing poor recovery. (Above) At 13 weeks; visual acuity finger counting, O.U.; marked clumps of amorphous pigment. (Below) At 23 weeks; visual acuity, 20/200, O.U.; amorphous clumps still present.



ous effect on vision, the drug was discontinued and treatment was started. Various steroids were used, including intravenous ACTH, and 150,000 units of vitamin A were given each patient daily. Oxygen inhalations caused transient improvement, which led to the use of nicotinic acid. This seemed to have a beneficial effect, and was continued in doses of 300 mg. daily for several months. Vitamin B_{12} and thiamin chloride were given to many of the patients. It is impossible to evaluate treatment in this series, and we are forced to conclude that the course of the disease depended largely on the daily dosage of the drug injected, rather than on any form of therapy.

Only two of the severe cases have failed to recover considerable vision. These are practically blind. The other six have improved both as to central vision and visual fields, until they could now be classed as moderately severe. The moderately severe have dropped into the mild class, and the mild have no loss of field or central vision. However, two cases have definitely regressed in visual acuity and fields at the eight-months period. There is some question whether the disease has run its course at this time, since such a short period has elapsed since the drug was discontinued.

Summary

1. Thirty-four patients with psychiatric disorders were treated with a new drug belonging to the phenothiazine group, called NP 207.

2. Of these patients, 28 suffered from retinopathy, varying from a mild to a severe degree (figs. 7, 8, 9, and 10).

3. It was characterized by a sudden and rapid loss of central and peripheral vision, and night blindness, beginning four to five weeks after ingestion of the drug.

4. The early ophthalmoloscopic findings were increase in retinal reflexes, redness of the optic disc, and dilation of retinal arteries and veins. Later, pepperlike pigment dots appeared in the retina in the midperiphery. In the more severe cases, these coalesced to form pigment clumps; and in patients who received larger daily doses, sheets of pigment, deposited in spokelike fashion, were found late in the course of the disease.

5. Most of the patients improved symptomatically after withdrawal of the drug, but all severe cases had residual signs and symptoms.

1304 Walker Avenue (19).

Acknowledgment

We wish to thank Dr. Kinross-Wright for permission to use a portion of his material. The discrepancy between the number of cases reported by him (32) and by us is due to the fact that we followed two cases in the out-patient department that he did not include. Our thanks are due Mrs. Joseph Breckenridge and Miss Robin White of the Department of Visual Education at the Veterans' Administration Hospital, Houston, for fundus photographs and slides used in this paper.

References

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2. Personal communication.
3. Kinross-Wright, V.: Psychiatric research reports (unpublished).
4. Verry and Rintelen: Ophthalmological Clinic, Zurich, and Ophthalmological Clinic, Basel, Switzerland (unpublished data).

PROLIFERATIONS IN THE VITREOUS*

A CLINICAL STUDY, WITH KODACHROME FUNDUS PHOTOGRAPHS

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One of the satisfactions of ophthalmoscopy is that it enables the physician to recognize variations from the normal, so as to state with a reasonable degree of certainty the source of the change, how it started, its course, and final termination. Prolific fields for pathologic investigations are the membranes which develop in the vitreous. For almost a century these have been labeled retinitis proliferans. The object of this paper is to present evidence which seems to warrant the statement that the overwhelming majority are proliferations in the vitreous.

It is well known that these new formations cannot develop from the retina, as such, but are derived from mesodermic tissue. The proponents of the retinal etiology state that the source is the mesodermic layer of the retinal vessels.

Large hemorrhages in the vitreous will completely disappear unless the underlying structures are damaged, when fibrous membranes may develop. Even small hemorrhages may lead to the same kind of new tissue. When new vessels appear in the vitreous, they may originate on or near the disc, but are infrequently associated with fresh vitreous hemorrhages. Two or more vessels, usually many, are bound together by a thin, sometimes scarcely visible, fibrous layer. Fibroblastic and perhaps neuroglial proliferations form as a sheet, a strand, a band, an encircling ring, as thin, gray vessel lined bags, yellowish masses or ribbons, crumpled bunches in a web, or with delicate almost invisible diaphanous extensions that can be easily seen only at the edge.

Vitreous membranes must be distinguished from epipapillary veils, persistence of Bergmeister's papilla or hyaloid remains. This is comparatively easy if it is remembered that these vestiges are always attached to the central excavation area of the disc.

A retinal fold associated with a distorted disc suggests a prenatal onset, but may be posttraumatic.

Tissue formations similar in position and appearance to those which follow intraocular inflammation or vascular degeneration may appear after an injury. The photographs of a few will illustrate the wide variety of fibrous membranes.

An intraocular foreign body penetrated the nasal side of the left globe and lodged in the orbit. There was a large vitreous hemorrhage. Ten months later a band in the vitreous obscured part of the nasal margin of the disc in its oblique course to the peripheral scar (fig. 1).

In another patient, a broad, thick, white ribbon extended horizontally from the choroidal scar about the macula to the vessels near the upper edge of an undistorted disc (fig. 2).

An unusual picture was that of a white mass with an upper and lower clawlike extension and a very thin membrane over but not attached to the lower third of the temporal portion of the disc, with an unevenly pigmented choroidal scar (fig. 3).

The inflammatory reactions range from a small filamentous cloud to membranes of marvelous beauty and texture, variable in distribution as well as density. The group shown is typical in that they rarely have attachment to the disc, but develop as the choroidal lesions become quiescent.

For several years cases have been reported where a membrane has formed in the vitreous over a choroidal scar. This was well displayed in the fundus of a 16-year-old girl,

* Presented at the 92nd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June 1956.

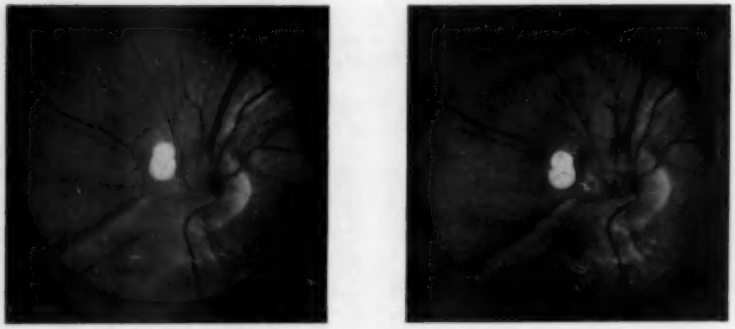

Fig. 1 (Bedell). Oblique, fibrous vitreous band following penetration of globe by foreign body (stereoscopic view).

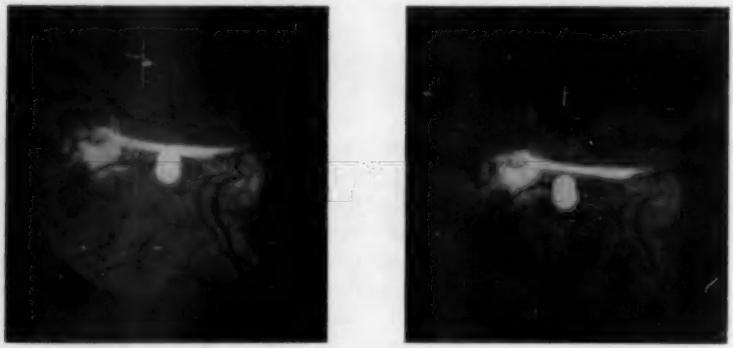

Fig. 2 (Bedell). A white ribbon from the disc to the scar in a traumatic choroiditis (stereoscopic view).

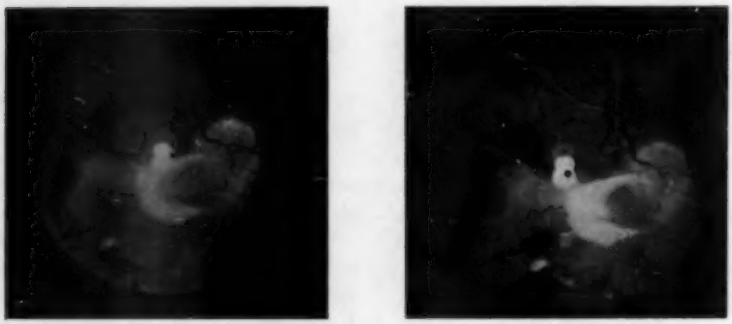

Fig. 3 (Bedell). Vitreous proliferation after an injury (stereoscopic view).

where, overlying the disc, there was a thin, wide band well outlined in its superior margin, which went almost horizontally outward to cover a pale choroidal scar and terminated about a heavily pigmented, white, elevated mass in the macular region (fig. 4).

After a tuberculous uveitis, a fibrous vitreous layer had a convex edge toward the distorted disc, the vessels were full, and a mass of agglutinated exudate was above (fig. 5).

One of the most beautiful of the post-inflammatory group showed two thick, white

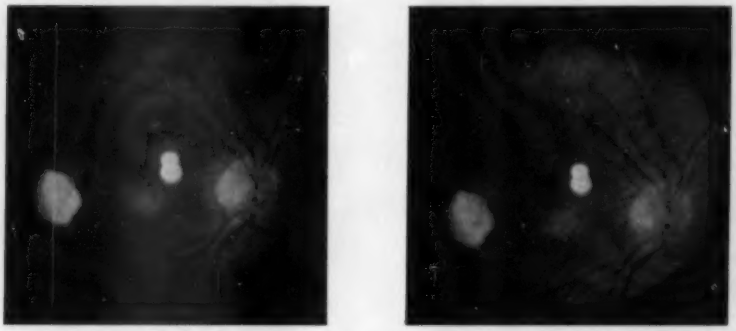

Fig. 4 (Bedell). Membrane cap on the disc extending to a choroidal scar (stereoscopic view).

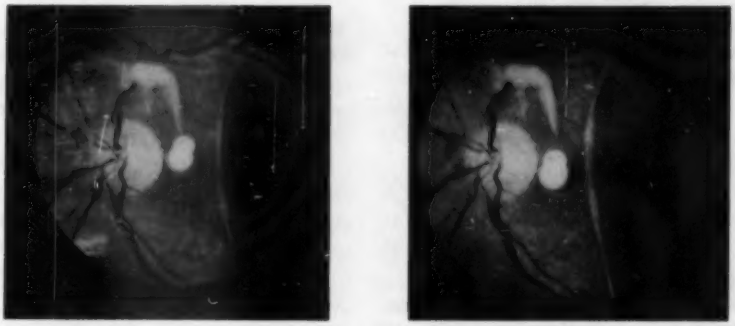

Fig. 5 (Bedell). Tuberculous retinochoroiditis, vitreous proliferations (stereoscopic view).

membranes which extended almost vertically upward in a **U**-shaped form (fig. 6). The base was close but not adherent to the retina. A glasslike upper margin joined the two. A superficial vessel dipped into this part of the membrane and swung around through the closed portion of the **U**. Between the limbs of the **U** there was a striated, sheer veil.

In a young women there was a large, diaphanous oval with new blood vessels on the surface and dilated ones beneath it over the surrounding retina, but with no definite connection to the disc or retina.

In a large group, most often in the course of diabetes, minute new blood vessels arise on or close to the disc as the inaugural sign of an advancing vitreous fibrosis.

For instance, a congeries of recent vessels at the disc projected into the vitreous with several, small, pale exudates in the macular area, a diabetic retinopathy (fig. 7).

At times the fundus changes are so extensive, the hemorrhages so numerous, and the blood vessel changes so obvious that there is little question as to their affiliation with the retinal vessels. This was true for a great

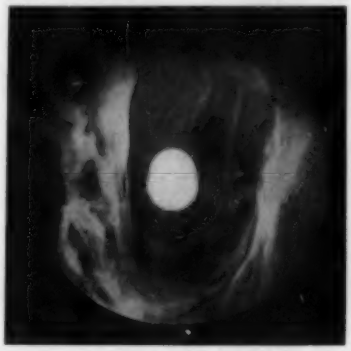

Fig. 6 (Bedell). Extensive proliferation. unproved cause.

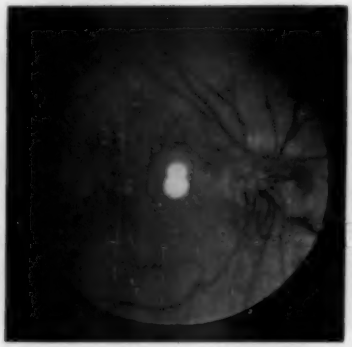

Fig. 7 (Bedell). Diabetic retinopathy, new vessels on the disc.

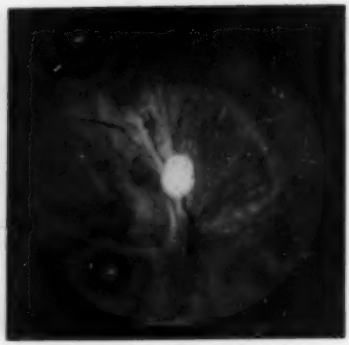

Fig. 9 (Bedell). Rete mirabile in a diabetic.

sheet which curved over the upper half of a partially concealed disc; it had a yellow-gray outlining edge and an irregular surface with several fine vessels and a few superficial hemorrhages (fig. 8).

Very early a smokelike film may cover a large blood clot, or appear on the surface of widely distributed smaller hemorrhages, as the initial sign of a viterous proliferation.

An interesting type is the elaborate anastomotic rete mirabile where the membrane is sharply outlined, vascular, and so thin that it looks much like the web of a frog's foot. Such a membrane was found in a 60-year-old man with diabetes, after 10 months of blindness (fig. 9).

In another patient, the exudate sheet was dense in all parts, but some opaque, yellow regions had an uneven surface, beneath which hemorrhages were seen in the retina (fig. 10). There were neither vascular nor membranous attachments to the disc.

When too little attention is paid to the fundus plane, some choroidal scars, especially those of bizarre shape, may suggest membranes in the vitreous, but close study will prove their location beneath the retina.

Three cases of sudden partial loss of vision are recorded in detail, for they graphically illustrate how vitreous membranes develop.

CASE 1

A 48-year-old woman who noticed a blur in her left eye three weeks before the first visit had hypertension, 230/110 mm. Hg. She was under observation for more than seven years, when a secondary cataract prevented further study.

Vision in the right eye was 20/20. Externally the

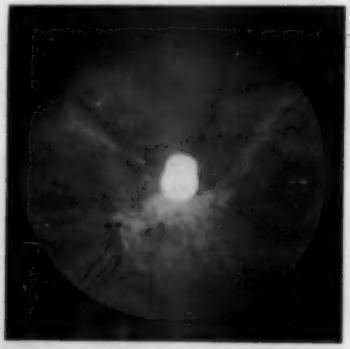

Fig. 8 (Bedell). Diabetic retinopathy, vitreous proliferation.

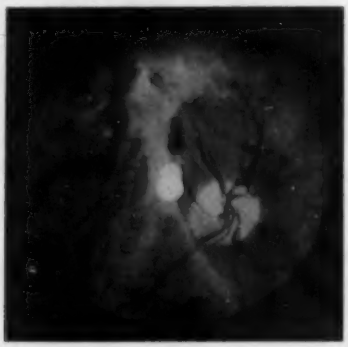

Fig. 10 (Bedell). Proliferating vitreous membrane in a diabetic.

Fig. 11 (Bedell). Case 1. Sudden occlusion, superior temporal branch artery.

eye was normal, the media were clear, but the retinal arteries were uneven in caliber and the vessel reflex increased.

In the affected left eye the vision was 2/200. The pupil was three mm. and reacted promptly to light and accommodation. The superior temporal branch of the central retinal artery was closed a short distance distal to the disc (fig. 11). A large, arcuately distributed hemorrhage spattered the upper temporal quadrant and trickled over the macular region.

Six weeks later the macular hemorrhages were much smaller. Near the center of the great extravasation, a large white area surrounded by dark blood clots was dominant. The affected artery was irregular in caliber, with an increased reflex and a white wall.

Seven weeks later the hemorrhage had followed the usual pattern, with much decrease in blood, smaller white spots, increased white wall arteries, a new group of fiine corkscrew compensatories, and more blood about the macular region.

Eight weeks later there was much less blood, larger compensatories, and an increase in the length of the white wall about the artery.

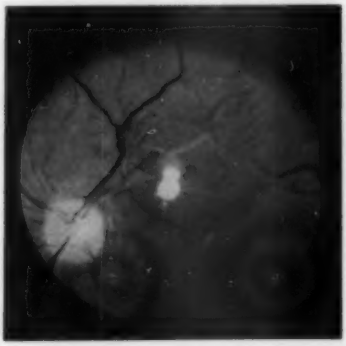

Fig. 12 (Bedell). Case 1. Twenty months later. Sclerosed artery, compensatory corkscrew vessels.

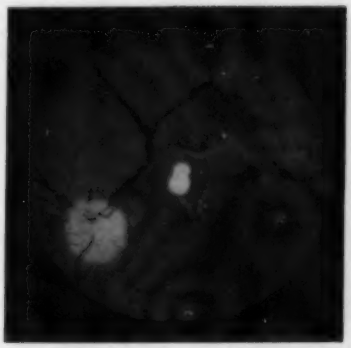

Fig. 13 (Bedell). Case 1. Four months later, exudate specks.

Six months later the white walled vessels were above and below the occluded one. The macular area was much clearer; only a few isolated hemorrhages remained.

Six months later the white vessel was traced to the lower loop; there was an increased tortuosity of a branch near the corkscrew. There were a few yellowish spots in the retina and minute, deep, granular hemorrhages.

Four months afterward the artery was more easily traced (fig. 12).

Four months later there were more hemorrhages and exudates about the macula, several visible artery divisions, and an edematous projecting mass near the junction of the partially closed artery and the darker open one, and more white specks (fig. 13).

Fifty-three months after onset an oblique, gray, soft-appearing band had developed inferior to the region of thrombosis.

Fifty-six months from the beginning there was an unusual change in the vitreous. A broad, cloudy, gray membrane extended from near but not at the disc obliquely in the direction of the 9:30-o'clock position, a vitreous proliferation.

Three months later there was more edema of the

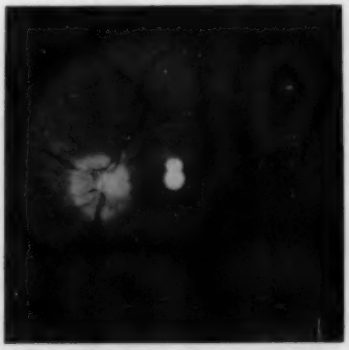

Fig. 14 (Bedell). Case 1. Four years after the onset. A broad membrane band in the vitreous.

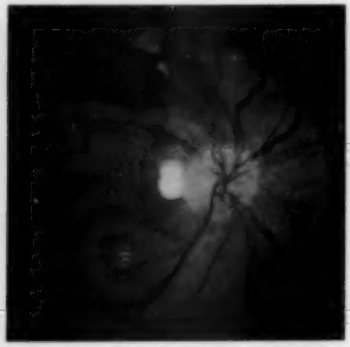

Fig. 15 (Bedell). Case 2. Abrupt superior temporal vein closure.

retina, and faintly visible retinal hemorrhages near the proliferation.

Five months subsequently the soft gray smudge below the proliferation had a vitreous hemorrhage on each end (fig. 14).

The band was denser three months later, the hemorrhages larger, the retina less distinct in detail, and the artery wall much whiter. Vision was light perception. At the end of three years the lens had become opaque.

This is a unique photographic record of a sudden occlusion of the right superior temporal artery, ending as a large, foldlike band in the vitreous and a secondary cataract.

CASE 2

When a 44-year-old woman was first seen two weeks after a blur appeared before her right eye, the vision was 20/200, with a superior temporal vein thrombosis and hemorrhages in the usual arcuate distribution. A knuckle of vein was prominent and a white vessel reflex. The disc was sharply outlined, the vessels normal, and the central excavation small. In the macular region there were a great many minute, more or less ovoid, deep, retinal hemorrhages and one bright red spot (fig. 15).

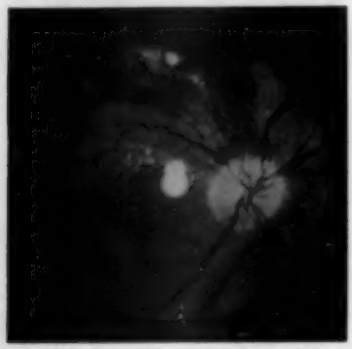

Fig. 16 (Bedell). Case 2. Six weeks later.

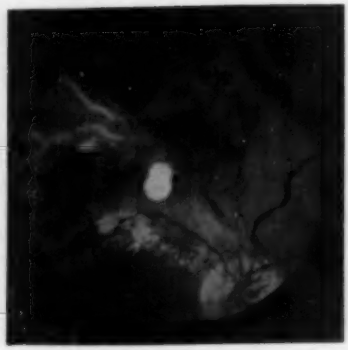

Fig. 17 (Bedell). Case 2. Six weeks later.

Six weeks later the blood was beginning to absorb. The deep hemorrhages were smaller with a very delicate, gray surface. The vessels on the disc were practically unchanged; surrounding the macular region were several radiating exudates (fig. 16).

Five weeks later there was no increase in the vessels on the disc, and very marked absorption of the extravasations; the stellate macular figure was breaking up, and the walls of the occluded vessel were whiter.

After six weeks the superficial blood had disappeared (fig. 17). The knuckle of vein was smaller and less prominent, but in the periphery where the closed vessel subdivided into two branches and the lower one divided again into two, the sclerosis was evident. The exudate about the macula was more homogenous and less stellate. While there were some new hemorrhages, most of the older ones had lost their arcuate form and become thinner. The vessels on the disc were increased in number.

Five days later there was a demonstrable web of new vessels on the paler disc; along the vein knuckle and overlying it there was an irregular oval of granular clot (fig. 18). The retinal exudate was decreased, although still thick. A new development was an ovoid, cystlike mass near the macula; this

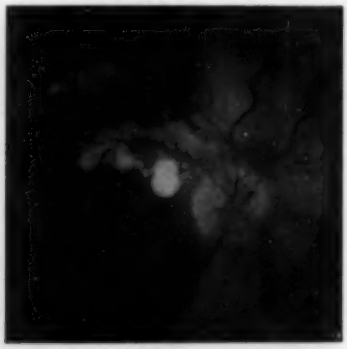

Fig. 18 (Bedell). Case 2. Five days later. Cystlike perimacular vitreous, granular hemorrhages.

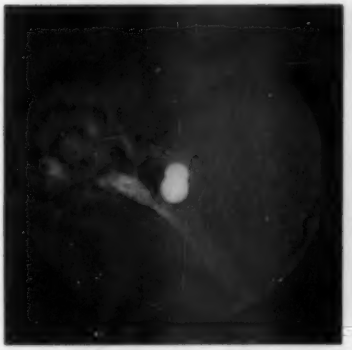

Fig. 19 (Bedell). Case 2. Five years after the onset. Falciform membrane with rete mirabile extremity.

was a little larger than the disc in diameter and beneath a retinal artery.

After the lapse of two months the vessels over the disc had increased in number, size, and prominence. The hemorrhage over the vein had disappeared, leaving narrow, new vessels. The exudate was both above and below the vein.

Four weeks subsequently the disc was dimly and only partially seen through a bloody-pink, cloudy vitreous. There were some fresh hemorrhages over the involved vessels.

Six months later the extensive extravasation in the vitreous had sufficiently cleared so that the margin of the disc was again visible, with its cap of small blood vessels. A sickle-shaped proliferating layer followed the distribution of the primarily occluded vessel.

After another eight months the vitreous proliferating sheet was distinctly outlined.

Two months later the proliferation extended up and out from just beyond the temporal margin of the disc, ending in a frayed, thick, white falciform membrane, including several small vessels in its widened termination. Vision was 20/30.

Physically, nothing remarkable was discovered in

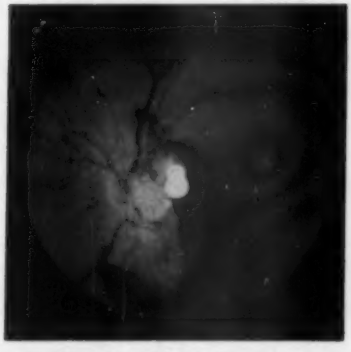

Fig. 20 (Bedell). Case 3. Immense vitreous hemorrhage after six months.

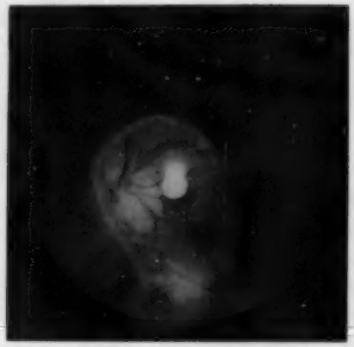

Fig. 21 (Bedell). Case 3. Three months later. A very large membrane, extending far down below the part pictured.

her general examination. The teeth were normal, the urine negative, while the hemoglobin and blood count were not remarkable. Throughout the entire period of observation the blood pressure stayed around 110/80 mm. Hg. She had had a complete hysterectomy three years before, and a kidney stone a year previously.

This complete life cycle of a sudden vein occlusion terminating in a curved, white strandlike vitreous proliferation is rarely photographed or even observed throughout its course.

CASE 3

A woman, 42 years of age, accidentally discovered, when an inflammation developed in her right eye, that the sight was defective in the left. The vision was 20/100. There was a thrombotic occlusion of the inferior temporal vein with a dense arcuately disposed extravasation. Complete physical examination disclosed no other pathologic alteration. The systolic pressure was never above 138 mm. Hg. The disc was clearly outlined with a moderate sized central excavation. The arteries and other portions of the fundus were not noteworthy.

Ten days after the first examination the blood was breaking up into isolated clots, and a vein was projecting above the surface.

Four months afterward there was a marked decrease in the blood, with several fine exudate spots above the macula, and the outlined vessels were more clearly seen.

Ten weeks later a very striking change presented, in the form of extremely large hemorrhages which almost entirely filled the temporal and a large portion of the inferior vitreous space (fig. 20).

After another three months a large, several-disc-diameter-sized membrane projected far into the vitreous, encircling the upper disc with a wide margin temporally and a narrow one to the nasal side (fig. 21). This great, gray, balloonlike membrane contained several yellow exudates and partially occluded vessels. It became narrower as it went downward, and was covered by several, new,

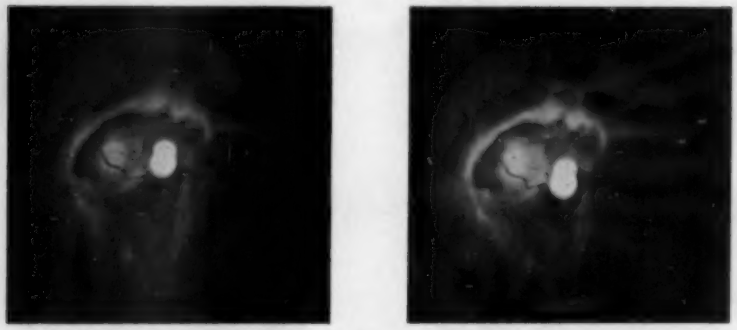

Fig. 22 (Bedell). Case 3. Two and a half years after the onset. A great vitreous membrane bag (stereoscopic view).

large and small vessels. There were a few isolated hemorrhages on the surface of the grayish margin. The immense sack was obliquely placed.

A month later the sacklike membrane was smaller and less vascular.

The final examination made two and one-half years later showed a large, semiopaque, vertically oval, white bag far in front of the level of the retina. Through the transparent center the pale disc could be observed. There were some dark, pigmented areas near the macular region and in the inferior nasal portion, where they formed an irregular crescent about three disc diameters in length. The vision was 3/200.

The right eye was unaffected, with no disturbance in the retinal circulation.

These cases of occlusion of a branch of a retinal vessel give a fair idea of how the vitreous membranes differ in distribution, density, and general characteristics. The immense vitreous proliferation in the last one is, in my experience, unusual.

Summary

Several cases of fibrous proliferation in the vitreous are presented, some from onset to termination, by means of single and stereoscopic fundus photographs. They show that it is rare to have an attachment at the disc, that the amount of new tissue is extremely variable and assumes innumerable forms, which range from a smoky cloud, or a thin almost invisible layer on the surface of retinal hemorrhages, to extensive dense sheets and bizarre masses. Careful inspection of these and many other photographs seems to establish them as vitreous proliferations, and gives support to the opinion that such membranes do not come from the retina and, furthermore, that they may form anywhere in the vitreous.

For some time the question of the correct location of newly formed intraocular membranes has attracted attention, so that it is hoped that this demonstration will be of assistance in future observations.

344 State Street (10).

A COMPARATIVE STUDY OF MYDRIATIC AND CYCLOPLEGIC AGENTS*

In human subjects without eye disease

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Introduction

Numerous mydriatic and cycloplegic agents are available but there is a paucity of well-controlled comparative data on their actions and side effects.[1-7, 13-18]

The present study compares the effects of 10 different agents, including two placebos, administered under controlled conditions by the double-blind technique, to white subjects with blue eyes, white subjects with brown eyes, and Negro subjects with dark eyes. Observations on one parasympathomimetic myotic agent were included for contrast.

Materials and Methods

The subjects of the study were 300 men and women without ocular disease ranging in age from 16 to 60 years; 15 were under age 21, eight over 55, and 277 between 21 and 55 years of age. Subjects with abnormal intraocular pressure (over 27 mm. Hg) or with a known past or present history of eye disease were excluded, as were those with any gross abnormality of the eye on external inspection or ophthalmoscopic examination performed prior to testing. No single eye was used for more than one test.

The 10 agents included normal saline (placebo 1), four-percent boric acid (placebo 2), neosynephrine hydrochloride (10 percent†), ephedrine sulfate (3.0 percent), pilocarpine hydrochloride (2.0 percent), scopolamine hydrobromide (0.2 percent), cyclogyl hydrochloride (1.0 percent‡), atropine sulfate (1.0 percent), homatropine hydrobromide (4.0 percent), and paredrine hydrobromide (1.0 percent‖). The solutions of the various agents were placed in dark bottles and labeled A through J so that the contents would not be known to either the investigator or the subjects at the time of testing. Each agent was tested in 10 white subjects with blue eyes (also gray and green), and in 10 white subjects with brown eyes (also hazel and black), and in 10 Negro subjects with dark eyes. Subjects with off-color eyes which were difficult to classify were not included in this study. Each examiner tested half of the subjects in each eye type group for each of the 10 agents. Thus any possible differences in technique between the two investigators were equalized.

The procedure was as follows: The intraocular pressure of the eye to be tested was measured in mm. Hg with a Schiøtz or modified Gradle-Schiøtz tonometer within two minutes after instillation of the 0.5 percent pontocaine. Twenty minutes was then allowed for complete recovery from the pontocaine before testing began.[8-11]

The pupil size of both eyes was then measured in mm. with a ruler placed on the bridge of the nose at the level of the midpoint of the pupil. One eye remained as a control. The other was tested with the agent.

The reaction to light and accommodation was estimated, using a light source of constant intensity and a Snellen Rating Card (#71-35-90, H 354) at 14 inches from the corneal surface. The result was rated by

* This work was done in the Experimental Therapeutic Unit under the sponsorship of a fellowship grant from the National Institutes of Health, in the Department of Medicine at The University of Oklahoma School of Medicine, and the Veterans Administration Hospital.

† Winthrop Stearns, Inc., brand of phenylephrine hydrochloride.

‡ Schieffelin & Company, brand of cyclopentolate hydrochloride.

‖ Smith, Kline & French Laboratories, brand of hydroxyamphetamine hydrobromide.

numbers being assigned to the six paragraphs of the card (largest print, bottom paragraph = 1; smallest print, top paragraph = 6; inability to read chart = 0).

Three drops of an agent were then instilled in the test eye. Forty minutes later the above procedures were repeated noting pupil size, cycloplegic effect (reaction to light and accommodation), and intraocular pressure.[12] The size of the pupil of the other (nontest) eye was also recorded. Finally, any unpleasant subjective or objective side effects attributable to the test agent were noted.

Results

The effects with respect to pupil size are shown in Figure 1. None of the variations in pupil size observed in any of the groups tested with a placebo differed significantly from the control (t-test: $p < 0.5$ and >0.1). Of the sympathomimetic agents tested, neosynephrine (10 percent) and paredrine (1.0 percent) produced significant mydriasis of essentially equal degree in all three eye types compared to the control ($p < 0.001$). These findings are in agreement with previous reports.[6,7,13,14] Ephedrine (3.0 percent), on the other hand, performed equally well in white subjects with blue and with brown eyes ($p < 0.001$ on both occasions) but failed completely in Negro subjects with dark eyes ($p < 0.5$ and >0.1) as previously reported by Chen and Poth.[15,16] Pilocarpine (2.0 percent) induced significant miosis in all three eye type groups ($p < 0.001$ in each instance), but apparently was less potent in Negro subjects with dark eyes. Of the parasympatholytic agents tested, scopolamine (0.2 percent), atropine (1.0 percent), and homatropine

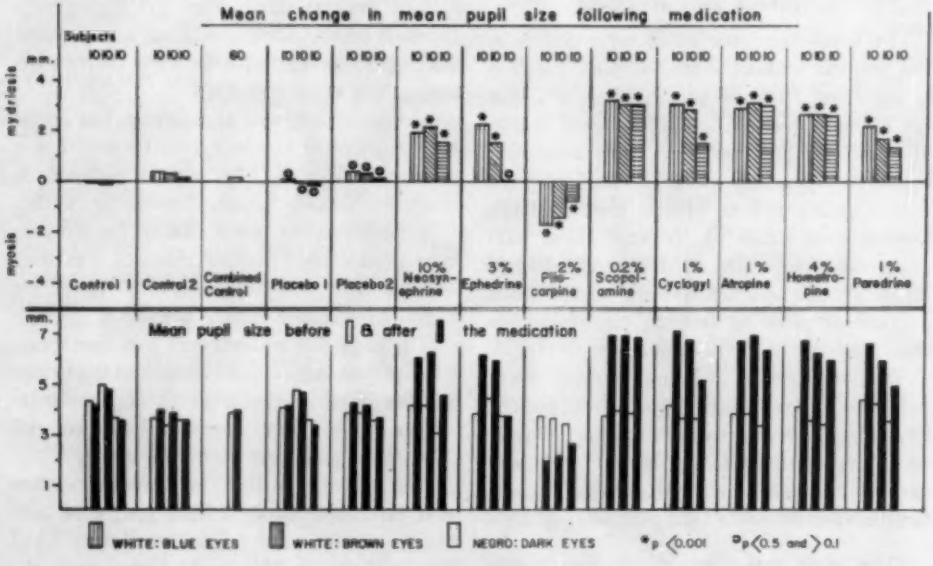

Fig. 1 (Barbee and Smith). Upper half: The mydriatic effect reflected by the mean change in mean pupil size for each eye type group in each medication group observed 40 minutes after instillation of the agents.

Lower half: The mean pupil size for each eye type group before and 40 minutes after the medication for each medication group.

NOTE: The p values are from t-tests using the combined control observations (60 subjects) made on the other (nontest) eyes of those subjects receiving placebo drops as the control group.

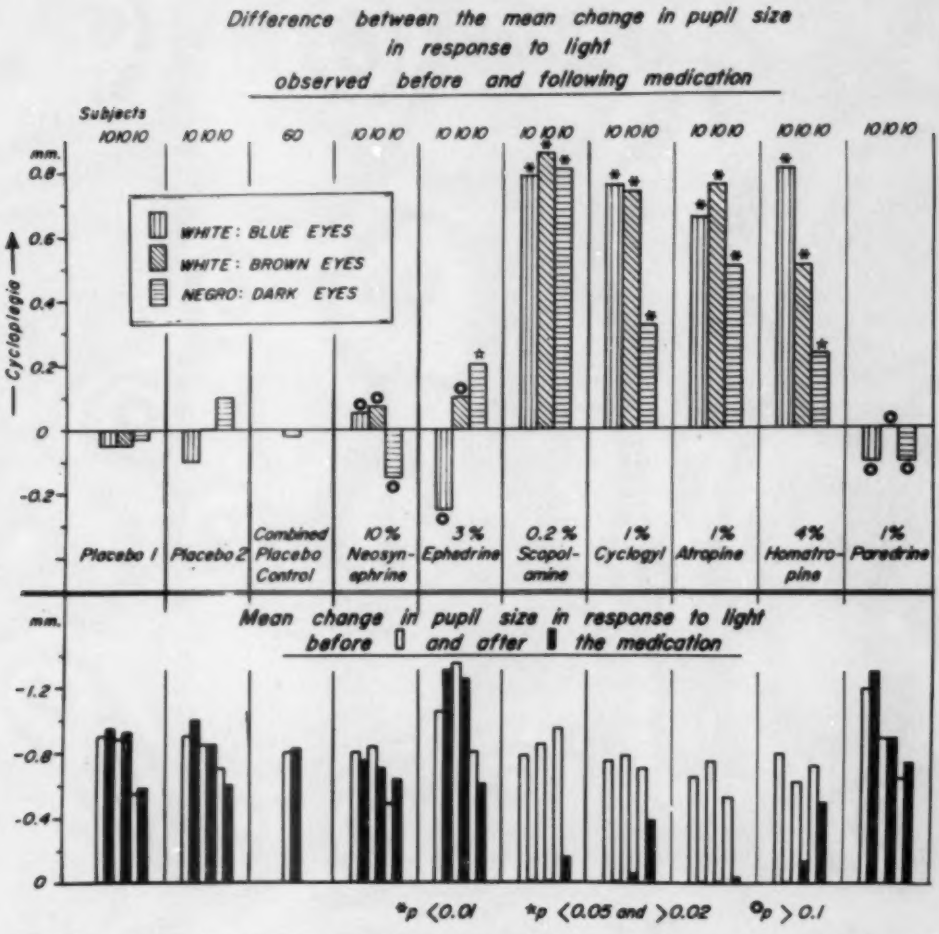

Fig. 2 (Barbee and Smith). Upper half: The cycloplegic effect reflected by the difference between the mean change in pupil size in response to light observed before and 40 minutes after the medication. (A cycloplegic effect is represented by upward extension of the bars.)

Lower half: The mean change in pupil size in response to light before and 40 minutes after medication for each eye type group in each medication group.

NOTE: The p values are from t-tests using the combined placebo observations (60 subjects) as the control group.

(4.0 percent) induced significant mydriasis of essentially equal degree in all three eye types. This effect was uniformly greater than that induced by the sympathomimetic agents (see fig. 1). Cyclogyl (1.0 percent) performed equally well in white subjects with blue eyes and brown eyes but was less potent in Negro subjects with dark eyes, although it still induced significant mydriasis in this latter group ($p < 0.001$). The mydriasis induced by cyclogyl in Negroes seemed more comparable, however, to that seen with the sympathomimetic agents than to that seen with the other parasympatholytic agents and is in contrast with previous reports.[1,2,5]

The cycloplegic effects are represented in Figure 2. The variations in response to light in the test eyes of the 60 subjects receiving placebo test drops were used as the control. The variations observed with the sympathomimetic agents (neosynephrine 10 percent, ephedrine 3.0 percent, and paredrine 1.0 percent) were not regarded as clinically significant ($p > 0.1$ in each instance, except in the case of ephedrine [3.0 percent] in Negro dark eyes where p was <0.05 and >0.02). The variations observed with the parasympatholytic agents (scopolamine 0.2 percent, atropine 1.0 percent, cyclogyl 1.0 percent, and homatropine 4.0 percent) were in general highly significant ($p < 0.01$ except for homatropine (4.0 percent) in Negro dark eyes where p was <0.05 and >0.02). Atropine (1.0 percent) and scopolamine (0.2 percent) induced almost complete and uniform cycloplegia in all three eye types. Cyclogyl (1.0 percent) and homatropine (4.0 percent) were effective in the white subjects with blue and with brown eyes, but cyclogyl (1.0 percent) and homatropine (4.0 percent) were less potent in Negroes with dark eyes.

Table 1 presents the data on impairment of accommodation (a change in rating of greater than three on the Snellen card). The only significant changes observed were with the parasympatholytic agents. Cyclogyl was uniformly 100-percent effective by our criteria, scopolamine was 100-percent effective in blue eyes, 90-percent effective in brown eyes, and 80-percent effective in Negro dark eyes. Both atropine and homatropine showed more inconsistency in their effect, yet produced a significant decrease in accommodation in all eye types.

The effects of ephedrine, neosynephrine, paredrine, and pilocarpine had disappeared within 24 hours, and those of cyclogyl and homatropine were gone in less than three days, while those of atropine and scopolamine lasted more than three days.

Table 2 presents the mean intraocular pressure expressed in mm. Hg and the range in tension observed in each eye type group for each agent. There was no significant increase in mean intraocular pressure in any of the drug groups tested.[18]

The principal subjective side effects were blurring of vision and/or burning. They were encountered with all of the agents except paredrine as shown in Table 3.

Objective evidence of conjunctival hyperemia and tearing was observed after pilocarpine in 10 of 30 subjects, after atropine and homatropine in six of 30 subjects (table 3). None of the other test agents gave significant objective side effects.

TABLE 1

THE PERCENTAGE OF MODERATE TO MARKED DECREASE IN ACCOMMODATION TO NEAR VISION 10 MINUTES AFTER MEDICATION IN EACH EYE TYPE GROUP (10 SUBJECTS) AND FOR EACH MEDICATION GROUP (30 SUBJECTS)

	Blue Eyes (10 subjects)	Brown Eyes (10 subjects)	Negro with Dark Eyes (10 subjects)	Total: All Eye Types (30 subjects)
Normal saline	10%	10%	10%	10%
Boric acid 4%	0%	0%	12.5%†	4%
Neosynephrine 10%	30%*	10%*	10%*	17%*
Ephedrine 3%	10%*	0%*	30%*	13%*
Scopolamine 0.2%	100%§	90%§	80%§	90%§
Cyclogyl 1%	100%§	100%§	100%§	100%§
Atropine 1%	40%‡	100%§	80%§	73%§
Homatropine 4%	100%§	60%§	60%§	73%§
Paredrine 1%	40%‡	30%*	0%*	23%*

*=$p>0.1$.
†=2 tests not valid and not included.
‡=$p<0.05$ and >0.02.
§=$p<0.01$ (chi square analysis).

TABLE 2

THE MEAN AND RANGE OF INTRAOCULAR PRESSURE (MM. HG) BEFORE AND 40 MINUTES AFTER MEDICATION

		Blue Eyes (10 subjects)		Brown Eyes (10 subjects)		Negroes with Dark Eyes (10 subjects)	
		Before	40 min. After	Before	40 min. After	Before	40 min. After
Normal saline	Mean	20.7	18.5	19.3	20.2	22.4	21.3
	Range	10–27	13–25	10–25	14–27	18–25	14–25
Boric acid 4%	Mean	20.7	19.7	18.1	19.0	22.1	21.9
	Range	15–24	15–22	5–24	5–24	17–27	14–25
Neosynephrine 1%	Mean	22.0	22.8	21.4	20.6	19.9	19.9
	Range	81–25	19–25	18–25	13–25	16–27	16–27
Ephedrine 3%	Mean	19.6	19.6	21.6	21.3	22.8	22.7
	Range	14–25	14–27	17–24	17–24	17–27	16–25
Pilocarpine 2%	Mean	21.2	21.0	20.7	21.0	21.7	21.1
	Range	19–25	17–23	14–27	14–25	61–27	12–28*
Scopolamine 0.2%	Mean	19.9	19.5	19.1	19.9	21.3	19.8
	Range	14–25	13–25	9–24	11–25	16–25	13–27
Cyclogyl 1%	Mean	21.1	22.4	21.6	23.7	22.3	23.0
	Range	14–27	17–27	20–27	20–27	18–27	18–27
Atropine 1%	Mean	20.8	20.4	19.4	20.1	22.4	23.2
	Range	17–25	12–27	14–25	15–28*	18–27	19–27
Homatropine 4%	Mean	20.7	20.8	22.3	22.3	21.3	21.6
	Range	16–27	14–26	13–27	17–30**	18–23	17–26
Paredrine 1%	Mean	21.1	20.8	22.0	22.7	22.2	21.0
	Range	18–25	17–25	17–25	22–25	19–24	16–23

* = One patient with slightly elevated intraocular pressure lasting less than 24 hours.
Note: There were no significant differences in mean values before and 40 minutes after medication. (t-test).

CONCLUSIONS

Ephedrine was found to be ineffective as a mydriatic in Negroes. Cyclogyl was less potent as a mydriatic in Negroes, acting more like a sympathomimetic agent rather than its companion parasympatholytic agents. Scopolamine, atropine, and homatropine yielded the greatest degree of mydriasis in the most uniform fashion in all three eye type groups.

Cycloplegic effects, as expected, were limited to the parasympatholytic agents. Homatropine, however, did not yield a significant cycloplegic effect in Negroes and cyclogyl was found to be less potent in Negro dark eyes than previously reported. Scopolamine and atropine uniformly produced the greatest cycloplegia in all three eye type groups.

Cyclogyl and scopolamine consistently

TABLE 3

THE PERCENTAGE INCIDENCE OF SUBJECTIVE AND OBJECTIVE SIDE EFFECTS NOTED IN EACH MEDICATION GROUP 40 MINUTES AFTER THE AGENT (EACH MEDICATION GROUP—30 SUBJECTS)

	Subjective Side Effects	Objective Side Effects
Normal saline	10%	0%
Boric acid 4%	33.3%	0%
Neosynephrine 10%	73%‡	3.3%*
Ephedrine 3%	56.6%‡	0%*
Pilocarpine 2%	83.3%‡	33.3%‡
Scopolamine 0.2%	100%‡	3.3%*
Cyclogyl 1%	80%‡	0%*
Atropine 1%	80%‡	16.6%‡
Homatropine 4%	73%‡	16.6%‡
Paredine 1%	30%†	0%*

* = $p > 0.1$.
† = $p < 0.05$ and > 0.02.
‡ = $p < 0.01$ (chi square analysis).

produced the greatest impairment of accommodation in all eye type groups. Homatropine and atropine were less consistent.

The effects of the sympathomimetic agents persisted less than 24 hours, those of cyclogyl and homatropine more than 24 hours but less than three days, and those of scopolamine and atropine for more than three days.

None of the test agents caused a significant increase in intraocular pressure. All agents, except paredrine and the placebos, caused subjective side effects, usually burning and/or blurred vision. Pilocarpine, atropine, and homatropine caused conjunctival hyperemia and tearing in some subjects.

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ABORTIVE FORM OF WILSON'S SYNDROME*

With dark adaptation disturbances

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Wilson's disease represents a family syndrome characterized by a great variety of clinical pictures. The complete syndrome includes: (1) neurologic symptoms of the extrapyramidal type, (2) liver cirrhosis, (3) Kayser-Fleischer ring in the cornea.

In individual cases, there may be differences in the intensity of the various symptoms. In some cases, symptoms involve the nervous system; in others, liver damage predominates (abdominal form). However, none of the symptoms taken separately is considered pathognomonic.

The Kayser-Fleischer ring appears in about 80 percent of cases. The character of this corneal change is not yet clear. It probably involves deposits of pigment-containing heavy metals, silver and copper. Melanowski's anatomicopathologic examinations for heavy metals were positive, but the author expressed no conclusive opinion as to the character of the changes. The recently dominant view is that copper deposits are involved. Cases in which the Kayser-Fleischer ring is the only symptom are exceptional. In the literature reviewed we have found but one such case, that described by Bothman and Rolf. However, another member of the patient's family exhibited the complete syndrome.

According to recent investigations, the disease is caused by defective amino-acid and copper metabolism, as evidenced by raised levels of certain amino acids and copper in the urine. The causes of the biochemical disturbances have not yet been conclusively elucidated. It is believed that they can be referred to the decreased level of ceruloplasmin (serum alpha-globulin of the molecular weight 150,000, originally isolated in 1948 by Homberg and Laurell). Ceruloplasmin is an oxidizing enzyme and, being a carrier of copper, contains about 0.35 percent of the latter. The normal content of ceruloplasmin in the plasma is 30 mg. percent.

Scheinberg and Gitlin established a decreased level of this metallic protein in the plasma of patients with Wilson's syndrome. The decreased level of ceruloplasmin is accompanied by an increased level of copper in the plasma and by a considerable retention of the former in brain and liver (Cumings et al., Bearn and Kunkel). The normal content of copper in the plasma is 90 to 150 gamma/100 ml. It rises in hepatolenticular degeneration up to 200 gamma/100 ml. However, according to other authors, decreased levels of copper were also observed in this disease (Wender, Wysocki, and Magas).

Bush et al., while determining blood protein fractions observed a decrease of the total copper level in the plasma, but found that it increased in the fraction which is weakly bound with albumins and induces the so-called direct reaction. This is confirmed by Bearn and Kunkel who demonstrated with the aid of the radioactive isotope Cu^{64} that, in patients with Wilson's syndrome, copper is combined mainly with the albumin fraction, while in healthy subjects it is found chiefly in the $alpha_2$-globulin fraction, in the form of ceruloplasmin.

Besides an increase of copper in the plasma, there is also increased elimination of copper in the urine and deposition of considerable amounts in the tissues (Schechter and Jones).

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Another essential abnormality observed in these cases is the distinctly increased elimination of amino acids in the urine (Brick). Usually the amino acid level of plasma and urine rises in cases in which there is considerable damage to the liver parenchyma. Contrariwise, in Wilson's disease, excessive amino acids are eliminated in the urine while the plasma amino acids remain normal or are even decreased. As a rule, liver tests in such instances give negative results (Ferraris). Frequently damage of the liver is not discovered until autopsy and, sometimes, only by a microscopic examination (Spillane et al.).

Recent investigations have demonstrated the essential role of renal disturbances. Increased amino acid elimination in the urine, without concomitant acidosis, results from impaired tubular reabsorption.

Liver cirrhosis is, in Wilson's disease, a secondary change caused by two factors.

1. Toxic damage to the liver parenchyma due to excessive storage of copper.

2. Shortage of amino acids eliminated in excessive amounts in the urine (so-called deficiency cirrhosis).

Thus, it is not surprising that clinical and laboratory symptoms of liver cirrhosis frequently fail to appear until the final stage of the disease, or sometimes remain undiscovered until death.

Recent investigations prove that Wilson's disease is caused by metabolic disturbances. Consequently, in doubtful cases in which clinical symptoms may be very scanty, diagnosis should be based primarily on laboratory examinations. Our case is presented to support our view.

Case report

The patient, S. W., a man, aged 22 years (case history 2392/55), was admitted to the ward on May 14, 1955, complaining of a burning sensation in his eyes and poor vision at dusk which hindered his movements in poorly lighted places. The symptoms had been present for five years. Night blindness became more intensive during the spring-summer period, while there was an improvement or even complete absence of visual disturbances during autumn and winter. The patient mentioned no other complaints regarding his eyes. Apart from the visual disturbances, the patient felt well except for periodic pains in the epigastrium after spicy meals.

Of past diseases, the patient mentioned nephritis at the age of 12 years, trauma in the region of the frontal bone (without fracture) three years before, and a fracture in the region of the left ankle one year before. Nourishment was always good and information obtained indicated no quantitative or qualitative deficiencies.

Family history. The brother of the patient's mother has suffered since childhood from "left-sided paresis" associated with choreic movements. The patient was unable to give more exact details. The father's sister died at the age of 18 years from an unknown disease. The patient's mother suffers from a heart disease and from "nerves." The patient's only brother is in good health.

Physical examination. Except for a trace of pain at deep palpation in the region of the gall bladder, no abnormalities were established.

Neurologic examination (Prof. Dr. W. Stein). There was noticeable hypertrophy of the muscles of the calf (gnome's calves). No pathologic changes were demonstrated in sensory and motoric nerves. No focal lesions of the central nervous system were found.

Eye findings. Vision O.U., was 6/6. The field of vision showed a slight peripheral concentric restriction, averaging about 10 degrees. Perception of colors was normal.

The protective system was unchanged. The eyeballs were pale, normally placed, and mobile. Intraocular pressure was correct.

The corneas showed a brownish-green ring, surrounding them and extending over 2.5 to 3.0 mm. of the periphery, slightly wider at the top and bottom. Slitlamp examination revealed that the changes were localized in the region of Descemet's membrane. The corneal ring was very distinct and could easily be seen with the naked eye. The anterior chamber was of proper depth; the aqueous humor was transparent. Iris and pupil were without changes.

Fundus. The discs were pink and clearly outlined. Diameter and course of retinal vessels were correct. The retinas were thin at the peripheries and had a somewhat yellowish-gray hue, occasionally showing a few gray dots. The macular region was unchanged.

Dark adaptation was tested several times by Carle's adaptometer. The first examination (May 30, 1955) was carried out before the beginning of the treatment. Dark adaptation proved distinctly impaired, as compared to that of a control person examined under identical conditions.

Beginning on June 7th, the patient received daily by mouth 90,000 u. of vitamin A (concentrate of the State Institute of Hygiene) in all 1,710,000 u. On June 22nd, by which time the patient had received 1,350,000 u. vitamin A, the second test was carried out. It differed very little from the first, and even demonstrated slight deterioration. Subsequently the patient was treated

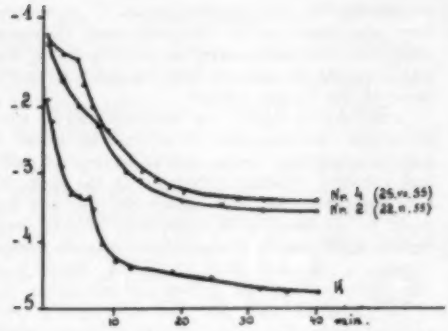

Fig. 1 (Segal et al.). Dark-adaptation studies. Ordinate: illumination (indices of illumination in lux units—logarithmic scale). Curve 2: After oral administration of 1,350,000 u. of vitamin A. (K) Dark-adaptation curve of a healthy subject of the same age under identical conditions. Curve 4: Just before discharge from hospital. Results of examinations 1 (May 30) and 3 (July 9), which were very similar, are omitted for reasons of clarity.

for 10 days by daily intramuscular injections of 90,000 u. of pasteurized vitamin A concentrates. After this series of injections, dark adaptation was tested under identical conditions for a third time. The result was the same.

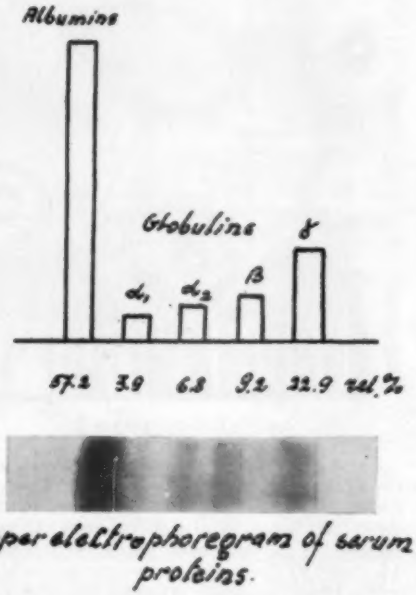

Fig. 2 (Segal et al.). Results of paper electrophoresis of blood serum proteins of the patient. Normal values are also indicated.

Fig. 3 (Segal et al.). Paper chromatography of free amino acids of the blood serum of the patient (a) compared with the serum of a healthy subject (b). Free amino acids in the patient's urine (c) compared with urine of a healthy subject (d).

On July 13th, daily intramuscular injections of 1.5 cc. of BAL were started and continued for 10 days. After that treatment, adaptation was tested a fourth time on July 25th; the results closely resembled the previous ones. Dark adaptation is illustrated in Figure 1.

Nine laboratory tests were made and showed no deviations from normal: Blood sedimentation rate, blood morphology, bleeding and clotting time, prothrombin index, Bordet-Wassermann reaction, urine analysis, Volhard's test, chest X-ray films, and blood urea level.

Blood-sugar curve, after administration of 50 gm. of glucose, was normal (after 60 min. and 120 min., 184 and 82 mg. percent, respectively).

Thymal turbidity test—1.6.
Lugol (Mallen's) test—0.
Bilirubin in the blood—0.2 mg. percent.
Blood platelets—119,500/cc.
Total plasma protein—6.60 gm. percent.

Paper electrophoresis of plasma proteins (modified after Ruszkowski): Albumin—57.2 percent; globulin, alpha$_1$—3.9 percent, alpha$_2$—6.8 percent, beta—9.2 percent, gamma—22.9 percent. Results of these tests are presented in Figure 2.

Urinary elimination of amino acids: 1.125 mg./1.500 ml. per day (normally about 600 mg.).

Chromatography of free plasma amino acids clearly indicated decreased levels of glycocol, alanine, and proline in the blood of our patient (fig. 3a) as compared to the plasma of a healthy

TABLE 1

RESULTS OF LABORATORY STUDIES

No.	Date	Level of Vitamin A in the Plasma μg. percent	Observations
1	June 8	95	Preliminary examination
2	June 24	73.2	After oral administration of 1,350,000 units of vitamin A
3	June 28	68.8	After oral administration of 1,710,000 units of vitamin A
4	July 9	46.5	After intramuscular administration of 900,000 units of vitamin A
5	July 26	50.3	After 10 intramuscular injections of BAL

subject (fig. 3b). Chromotographic examination failed to indicate any distinct differences in the total plasma amino-acid content as between our patient and a healthy subject.

Chromotography of free amino acids in the urine clearly pointed to an increased elimination of cysteine, lysine, glycocol, alanine, and proline (fig. 3c) as compared to the urine of a healthy subject (fig. 3d).

The level of vitamin A in the blood was determined repeatedly. The results of pertinent analysis are shown in Table 1. Emission spectrum analysis of urine was within the 2,500 to 3,300Å wave band (Hilgar type spectograph).*

A sample of 250 ml. of urine was taken from the daily elimination, desiccated, and ashed at 300 to 400°C. Two characteristic copper lines were distinctly visible between the 3,247Å and 3,273Å waves. Intensity of the lines was about three times greater than in the case of a healthy subject (fig. 4).

It should be mentioned that the electrodes used in these determinations contained only a minute trace of copper. The same electrodes were used in examining the urine of both the patient and the healthy control. Differences obtained from the two analyses distinctly indicated a larger content of copper in the urine of our patient.

Within the 2,567.98Å, 2,575.1Å, and 2,575.4Å wave bands there were three distinct emission lines of aluminum, about twice the intensity of analogous lines in the urine spectrum of a healthy subject. The electrodes contained no aluminum.

Within the 2,800Å wave band a slight line of manganese was established. Traces of manganese were also found in the electrodes used. However, using the same electrodes, no corresponding line was revealed in the spectrum obtained from the urine of the healthy subject.

In addition to copper and aluminum, which were either not demonstrated at all in the urine of healthy subjects or were revealed in lines of much less intensity, spectrum analyses of the urine of both the patient and the control demonstrated the presence of: phosphorus, 2,530 and 2,550Å; magnesium, 2,800Å (five characteristic adjacent lines); calcium, 2,900Å and 3,170 to 3,180Å. There were also numerous lines of sodium and potassium.

The same technique was used in analyzing spectrographically the ashes of the patient's whole blood. Here, too, the copper lines were more intensive than in those of three healthy subjects. These spectrographs are not reproduced since they are considerably less clear than those of the urine, due to the large iron content of blood and the resulting numerous characteristic lines.

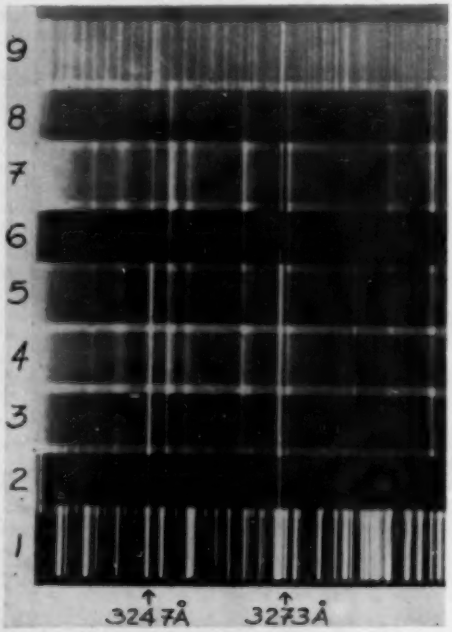

Fig. 4 (Segal et al.). Emission spectrum within the 3,225 to 3,310Å band. Several spectra are present in the following succession (from bottom to top): (1) Spectrum of iron (control). (2 and 9) Spectra of the carbon electrodes used (control). (6, 7, and 8) Spectra of the healthy subject's urine ashes (three analyses). Distinct intensive copper lines can be seen in the 3,247Å and 3,273Å bands. They are well visible in the urine of the patient in the spectrographs 3, 4, and 5 only.

* For the spectrographic analyses we are indebted to A. Idzikowski, Ph.D.

Discussion

Despite scanty clinical symptoms, we believe that the results of examinations warrant the diagnosis of Wilson's syndrome.

Neurologic examination gave a negative result. Except for traces of pain in the right hypochondrium, established by deep palpitation, no pathologic changes in the abdominal cavity were established. Functional liver tests (thymol and lugol tests), prothrombin index, bilirubin level in the blood, electrophoresis of plasma proteins, and glycemic curve also failed to indicate any considerable liver damage.

Of all the classical symptoms, we found merely the Kayser-Fleischer ring. Cases have been described in which the Kayser-Fleischer ring was not accompanied by other symptoms of Wilson's syndrome, but coincided with other disturbances, for instance, encephalitis. Based on his own extensive material as well as on the literature, Konowalow thinks that until now there is no trustworthy description of a case in which the Kayser-Fleischer ring appeared outside Wilson's syndrome. We are unable to express a conclusive opinion in this respect. In our case we looked upon corneal changes as merely confirming our diagnosis and not as the exclusive symptom of Wilson's disease.

The biochemical changes are of essential importance in the pathogenesis of the disease. We found in our patient distinctly increased elimination of amino acids in the urine, while the blood plasma showed no appreciable changes in the total amino-acid content. At the same time, spectrum analyses revealed a distinctly increased elimination of copper in the urine.

A past history of nephritis in our patient might suggest that the increased elimination of amino acids resulted from renal damage. However, such supposition is contradicted by: (1) Absence of any clinical symptoms, (2) negative results of urine analyses and the Volhard test, and (3) a normal urea level in the blood. In addition, as shown by recent investigations (Lathem et. al., 1955), there are no changes in amino-acid content between blood and urine, in patients with acute or chronic glomerulonephritis.

Thus, despite absence of central-nervous system and liver disturbances, we feel justified to diagnose in our patient the syndrome of hepatolenticular degeneration. Our patient presents an abortive form of the syndrome in which metabolic disturbances have failed to produce distinct lesions in other organs.

It might be that the data relating to the unknown disease of the mother's brother, supplied by our patient, would indicate the existence in the family of a more complete clinical picture. Unfortunately we had no opportunity to examine the remaining members of the family.

The second problem to be discussed is the question of dark adaptation disturbances which, of the few objective symptoms, became conspicuous and prompted the patient to seek medical advice.

Night-blindness is not one of the classical symptoms of the syndrome. However, we have found in literature a number of such descriptions (Metzger, 1922; Gala, 1925; Pillat, 1933; Konowalow, 1948). In Pillat's case, the fundus of both eyes showed extensive whitish foci of degenerative changes in the inner retinal layers, particularly at the periphery. The author believed these changes to be closely linked to Wilson's syndrome and assumed that they are frequent but usually disregarded, since establishment of corneal changes is, in most cases, accepted as sufficient evidence of the disease. Since that description was published, we have not come across similar reports, which seem to contradict the author's view.

Konowalow believes adaptation disturbances in these patients to be the result of vitamin-A deficiency. Decreased vitamin-A reserves might be explained by liver cirrhosis. In Gala's case, besides adaptation disturbances, there was xerophthalmia, which seems to corroborate this view.

In our case we can definitely deny vita-

min A deficiency. Any such shortage is refuted by the information obtained and by repeated determinations of plasma vitamin-A content. Initial examination indicated sufficient reserves of the vitamin in the organism. Oral administration of large doses of vitamin-A failed to enhance dark adaptation and, more important, the level of the vitamin in the plasma did not rise. There remained, however, the possibility of disturbances in intestinal absorption of the vitamin. We, therefore, administered large doses of the vitamin by the intramuscular route, but this treatment also failed to improve adaptation and caused no rise in its level in the plasma. This seems to prove that other mechanisms are responsible for the impaired adaptation.

Eye examinations pointed to discrete degenerative changes on the periphery of the retinas of both eyes and to slight concentric restriction of the fields of vision. We believe that impaired night vision might have been the result of impaired peripheral functions of the retinas. Besides, while examining patients with retinal degenerations of various origins, we have frequently met with considerable dark-adaptation impairment in cases with discrete ophthalmoscopic changes.

There remains the question whether the ophthalmic changes described are in close pathogenetic relation to the entire pathologic picture or whether the case reported is one of pure coincidence.

Available results do not warrant a conclusive reply but it seems very likely that, in this case, impairment of retinal metabolism was the ultimate result of general disturbances. (Is it possible that deposition of copper in the retinas is in question?)

The role of the liver in retinal disturbances cannot be definitely excluded. Negative liver function tests do not exclude the presence of other disturbances; for instance, in lipid metabolism involving vitamin A the functional tests performed have no bearing at all.

BAL treatment failed to enhance dark adaptation. Nevertheless, in our opinion, this fact does not exclude relationship between the retinal changes and the principal disorder, since improvement after BAL occurs only in some cases of Wilson's disease.

Summary

Contemporary views on the pathogenesis of Wilson's syndrome, with specific reference to amino-acid and copper metabolism, are reviewed.

A case of impaired dark adaptation, in which the Kayser-Fleischer ring was found without accompanying liver and central nervous system damage, is presented. Laboratory tests revealed distinctly increased urine elimination of some free amino acids and of copper (spectral analysis). The results of these tests provided a basis for diagnosing an abortive form of Wilson's syndrome.

Examinations revealed considerable impairment of dark adaptation while the plasma vitamin-A level was high. Large doses of vitamin A, orally and parenterally, as well as BAL treatment, proved ineffective.

We believe that night-blindness resulted from degenerative changes at the periphery of the retinas, as well as minute changes in the fundi, which might have been caused by biochemical disturbances of the Wilson type but could not be attributed to vitamin-A deficiency.

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BENIGN CALCIFYING EPITHELIOMA OF THE EYELID*

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Benign calcifying epithelioma of the eyelid is a fairly common cutaneous tumor which was first described by Malherbe in 1880. The tumors may occur on any part of the body but they are most common in the region of the head and neck (Ch'in). The involvement of the upper eyelid has been reported only four times in the ophthalmic literature (Ashton, 1951; Kara, 1954; Kornblueth and Liban, 1955; Ricci, 1956). However, the diagnosis is easily made by histologic examination and, since the tumor is usually mistaken clinically for a sebaceous cyst, we believe it to occur far more frequently in the lid than the paucity of reported cases would suggest.

The orbital portion of the upper eyelid is the only site of ocular involvement. The tumor presents as a firm, round, movable subcutaneous lump attached to the skin, 0.5 cm. in diameter to the size of a fist (Malherbe) in size. The tumors are slow growing and are prone to undergo calcification and bone formation. Young adults and females seem more predisposed than others (Lever and Griesemer). Malignant degeneration does not occur. Excision, even though incomplete, does not seem to be followed by recurrence.

Four patients with benign calcifying epithelioma of the upper eyelid have been seen recently in the Ophthalmology Section of the University of Chicago Clinics. The histologic picture of each case is essentially similar.

Grossly, the nodules appear as a yellowish-gray firm lump embedded in the skin and surrounded by a connective tissue capsule. The capsule is frequently incomplete and on excision the nodule may be incompletely removed. On cut section, the mass may be filled with a gritty solid material, although calcification is by no means a constant finding.

Microscopically, the tumor is a well-demarcated, encapsulated mass, lying in the subcutaneous tissue. It is composed of islands of epithelial cells, both necrotic and viable, embedded in a connective tissue

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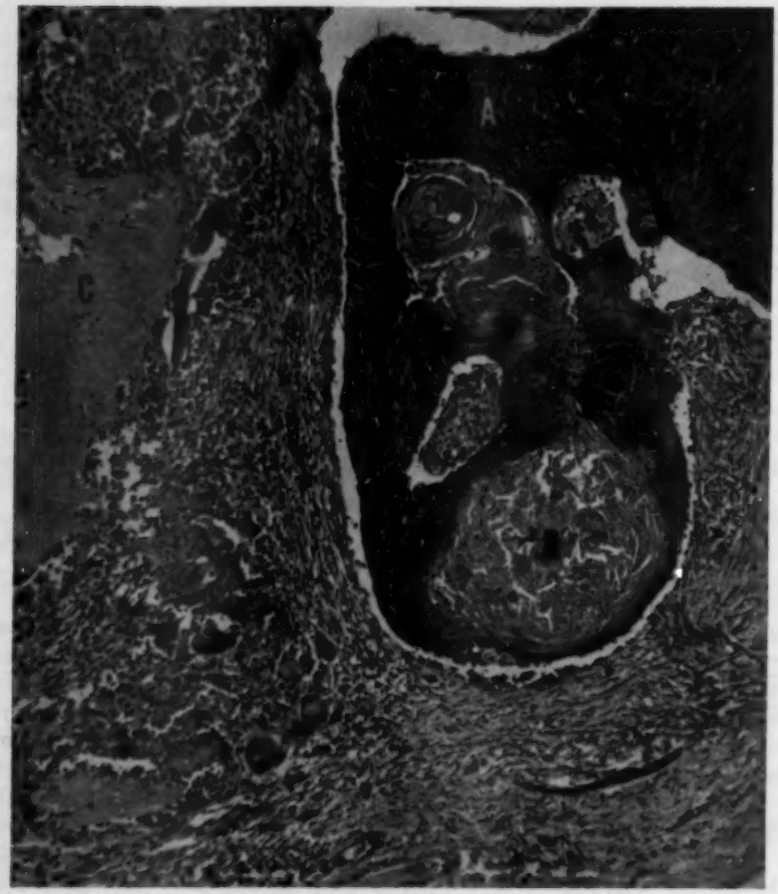

Fig. 1 (Mitchell and Newell). A large mass of viable basophilic cells (A) containing an area of necrosis below; (B) shadow cells are present on the left; (C) many giant cells are present in the stroma. (Hematoxylin and eosin. Original ×115.)

stroma. The epithelial cells are of two types, "basophilic cells" and "shadow cells." The basophilic cells possess large, round or elongated, deeply staining nuclei and little cytoplasm. In areas they show parakeratotic transformation into the pink "shadow" cell nests which differentiate this tumor from the ordinary squamous cell epidermal cyst. The shadow cells have a distinct border but take no nuclear staining. Instead they show a central unstained "shadow" at the site of the nucleus. Many nests have a necrotic granular center. Calcification, which frequently occurs, is present in large sheets in the shadow cells. Ossification of the calcified araes was not present in any of our cases. The stroma of the tumor contains numerous multinucleated giant cells adjacent to the masses of shadow cells. In addition, areas of metablastic cornification and epithelial pearls are present.

Case 1

A 24-year-old Negro registered nurse stated that a small nodule had developed in the upper right eyelid during the previous two months. Examination indicated a small, firm, nontender, freely movable nodule located in the subcutaneous tissue just below the right supraorbital ridge on the outer aspect of the eyelid.

A diagnosis of possible sebaceous cyst was made and the mass was excised using local infiltration anesthesia. The specimen consisted of an encapsulated, round, firm, slightly irregular mass about one cm. in diameter. It was solid and at the time of excision was not suggestive of a sebaceous cyst in appearance or consistency. Pathologic examination indicated a typical small calcifying epithelioma containing large numbers of uniform basophilic "germinal bud cells" in sheets and small groups. The tumor was removed December 24, 1955, and there has been no recurrence.

CASE 2

The patient, a 37-year-old Japanese woman, complained of a painless, rapidly growing mass in the lateral portion of the left brow. It had been noticed five weeks previously. Examination indicated a slightly fluctuant mass fixed to the skin at the junction of the middle and lateral third of the left orbital portion of the eyelid.

A diagnosis of sebaceous cyst was made. It was excised without difficulty in the out-patient section. At the time of excision a large amount of cheesy material was expressed from the mass, which could not be removed in its entirety because of the friability of the capsule.

Microscopic examination indicated a benign tumor consisting of sheets of basophilic epidermoid cells with shadow and necrotic cells embedded in loose connective tissue. A foreign body giant cell reaction was present in the areas of necrosis. Early calcification was present. A diagnosis of benign calcifying epithelioma was made, and the pathologists indicated that the tumor had been incompletely excised.

The patient has been followed by the neurology section because of migraine headaches. There has been no recurrence of the tumor, despite the incomplete excision, for a four-year period.

CASE 3

The patient, a 46-year-old white woman, was seen in consultation while hospitalized for a protruded lumbar disc. She stated that there had been a painful swelling of the left eyebrow for four

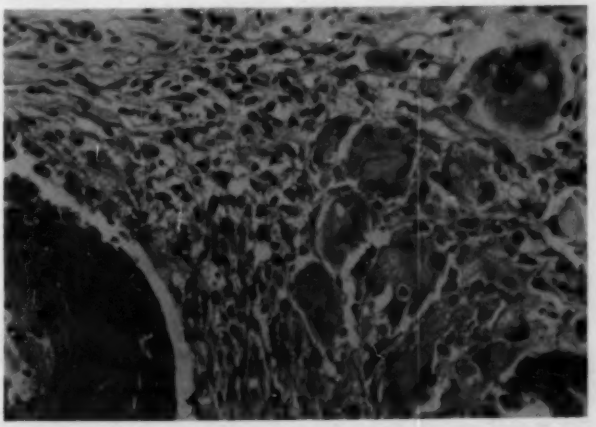

Fig. 2 (Mitchell and Newell). Section showing giant cells in the stroma. (Hematoxylin and eosin. Original ×490.)

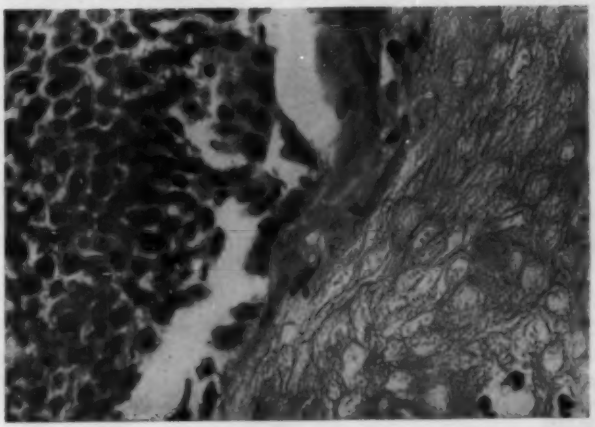

Fig. 3 (Mitchell and Newell). Transformation of the basophilic cells into shadow cells. The shadow cells take no nuclear staining. (Hematoxylin and eosin. Original ×900.)

months. Examination indicated a small, fluctuant mass involving the outer one third of the upper lid, which was diagnosed as an infected sebaceous cyst. It was excised without difficulty. Examination indicated a calcifying epithelioma without calcification. The tumor was well encapsulated and extended downward from the dermis. Inside the capsule was a sheet of predominantly basophilic squamous cells of various thickness, forming an almost complete ring. The remainder of the tumor consisted of rather loose connective tissue with a pronounced granulomatous reaction including many giant cells, especially in association with sheets of dead cells.

CASE 4

The fourth patient, a 50-year-old white woman, had been treated at the University of Chicago Clinics since August, 1953, for a reticulum cell sarcoma causing a bilateral hydronephrosis. April 7, 1956, the patient stated that she had had a soft, freely movable mass in the left eye brow for the past several months. It was believed that this represented a reticulum cell sarcoma and the small mass was excised without difficulty. The tumor had a soft capsule which ruptured with manipulation and it was then diagnosed as a sebaceous cyst.

Pathologic examination indicated trabecular sheets and islands of shadow epidermis. Foreign body giant cells and macrophages were present in great numbers. A diagnosis of subcutaneous calcifying epithelioma was made. The eye has been symptom free since the excision.

COMMENT

The exact histogenesis of these tumors is unknown but it is most probable, according to Lever, they are derived from the primary epithelial germ, an embryonic structure, which has the potentiality of differentiation into hair, sebaceous glands, and apocrine glands. The tumors are of histologic interest only in that they are benign and do not recur. The frequency with which this diagnosis had been made pathologically at this institution suggests that this is a common tumor of the lid. However, unless routine studies are made of all material, the resemblance of this tumor to a sebaceous cyst may lead to its not being diagnosed properly.

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FUNDUS PHOTOGRAPHY BY ELECTRONIC FLASH

PART IV. SINGLE EXPOSURE STEREOPHOTOGRAPHY OF THE FUNDUS

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A. INTRODUCTION

In Part III of this series of papers, a new electronic flash fundus and anterior segment camera was described. In this report I shall show how this unit may be used to take single-exposure stereophotographs.

Thorner laid the foundation for stereoophthalmoscopy, in 1903, in his "Die Theorie des Augenspiegels."[1] He published the first stereofundus photographs six years later.[2] They were made through his reflex-free ophthalmoscope by turning the instrument upside-down between exposures.

Further stereofundus photographs awaited the commercial production of the Nordenson camera. Nordenson himself wrote the first paper in 1926,[3] proposing that the patient's head be made to lie horizontally first on one side and then the other in front of the camera. In 1927, papers appeared by Metzger,[4] Bedell,[5] Wessely,[6] and Stock.[7] Metzger, Wessely, and Stock changed the patient's fixation between exposures and Bedell moved the camera. Excellent stereophotographs have been made by all of these methods but none of them is reliable and none of them allows accurate calculation to be made from the photographs of differences in depth.

In 1930, Nordenson published the first "absolute," that is, simultaneously exposed, stereofundus photographs.[8] They were made with the specially constructed Zeiss-Nordenson stereofundus camera. In 1953, Norton described a method of making absolute stereofundus photographs[9] by mounting a 35-mm. stereocamera on a Bausch and Lomb binocular ophthalmoscope and thus simultaneously making the two exposures. Exposure time, however, becomes one second for Kodachrome.[10] More recently[11] Norton converted this unit to the use of an FA5 Xenon arc lamp. With the new high-speed Ektachrome film (ASA 32) he can expose at 1/20th of a second.

B. STEREOTECHNIQUE

The crude method of taking two separate photographs from different angles is obviously undesirable in photographing living material. However, making two photographs simultaneously on film which is then separated and mounted for viewing, is not entirely satisfactory either. Such subsequent mounting must be very accurately done, especially if the photographs are to be projected, and special double projectors must be used. Although companies like Eastman Kodak will return stereophotographs in stereo cardboard mounts, these mountings are not accurate enough for projection purposes and all such slides have to be remounted.

A much more satisfactory method for making stereophotographs is beginning to be employed by some European manufacturers, including Zeiss (Contax), Leitz (Leica), and Kern-Paillard (Bolex): the split-frame format. Stereolenses are mounted with their optical axes spaced one-half the film width apart, and two pictures are then made, one on each half of a normal film frame. The necessary effective displacement of the lenses for a natural stereo result is achieved by placing a mirror and/or prism system over the camera lenses. Such an effect can indeed be obtained with a single camera lens and a mirror system such as the Stereo-Tac unit made in this country or the new Ihagee adaptor for the Exakta cameras. Both Kin Dar and Ihagee have recently introduced systems for Exakta close-up photography, the former utilizing two lenses and the latter using one lens and a prism attachment.

The advantages of the split-frame format stereosystem are numerous. The camera body can be used both for stereo and for ordinary photographs merely by interchanging lenses. The stereophotographs are automatically aligned in mounting since they are never cut apart. Ordinary mounts can be used; thus special files are not needed. And finally, any ordinary projector may be used to show the pictures merely by replacing its lens with a special stereolens or by adding a mirror system over it.

C. Calculation of depth

The use of absolute stereophotography would make possible the calculation of differences in depth of various parts of the fundus. The amount of papilledema or the height of a tumor for instance could be expressed in millimeters and a quantitative evaluation made of their course in the third dimension.

Theoretically the difference in depth (Δ) between two points on the fundus can be expressed as:

$$\Delta = \frac{\delta(do_2)^2}{\delta do_2 + S di_2} \cdot \frac{f_{eye} d_{eye} + dn_1(d_{eye} - f_{eye})}{f_{eye} di_1}$$

Use of an approximate formula would introduce an error of less than five percent in any measurable lesion and would greatly facilitate calculations:

$$\Delta \cong \frac{\delta(do_2)^2 M_t}{S(di_2)^2}$$

Assuming the patient's optic papilla to be 1.5 mm. in diameter:

$$\Delta \cong \delta Q \phi_n$$

Where:

δ = (the distance between the images of the two points on one stereoframe)
minus
(the distance between the images of the two points on the other stereoframe).

do_2 = the distance from the stereocamera lens to its object.

di_2 = the distance from the stereocamera lens to the film.

S = the effective separation of the stereolenses.

d_{eye} = the distance from the nodal point of the eye to the fundus.

f_{eye} = the focal length of the eye.

dn_1 = the distance between the nodal point of the eye and the nodal point of the ophthalmoscope lens.

di_1 = the distance from the ophthalmoscope lens to the image it forms of the fundus.

M_t = the total magnification of the image. This can be easily approximated by dividing the diameter in millimeters of the optic nerve on the photograph (ϕ_n) by 1.5: $M_t \cong \frac{\phi_n}{1.5}$.

$Q = \frac{\frac{2}{3}(do_2)^2}{S(di_2)^2}$ = a set of values which can be computed and marked on a "focusing" scale on the bellows. One would simply read and record this value whenever a stereophotograph were taken.

ϕ_n = the diameter of the image of the optic nerve on the photograph.

Thus the procedure for the quantitative determination of the height of a fundus lesion other than papilledema would be:

1. Take a stereophotograph of the lesion recording Q as read from a scale on the bellows device.
2. On the photograph, measure δ and ϕ_n.
3. Multiply these three values together.

Note that values obtained by this simple technique have some limitation in their usefulness in comparing one patient with another because of our assumption that all patients have optic papillae 1.5 mm. in diameter. This would be of no consequence in the usual case, however, where one is following a lesion in a given patient. We are, however, trespassing upon research techniques: further elaboration of this subject does not belong in this paper, and may be presented later.

D. Apparatus

The fundus/anterior segment camera unit described in Part III of this series can be very easily converted to stereophotography by replacing the camera lens with a suitably made stereolens system and adding appropriate masks (fig. 1). The focal length of the lenses used will depend somewhat on how large an area of retina one wishes to photograph. The separation of the optical axes in turn will depend on the choice of focal length. The mathematical extension of the split-frame format to hyperclose-up photography, as in the fundus camera, leads

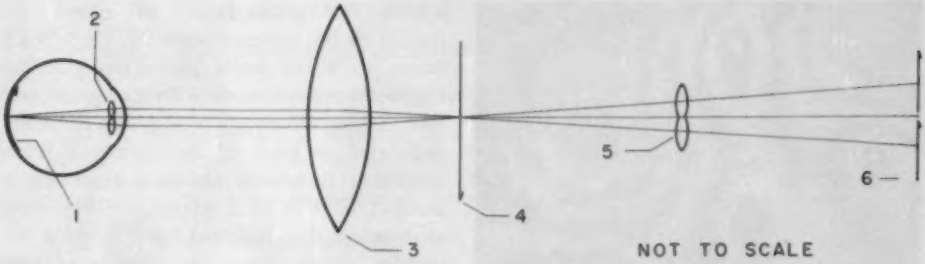

Fig. 1 (Drews). Optical system for stereofundus photography using split-frame format. The drawing is a top view and is not to scale. (1) Fundus. (2) Image of the stereolenses formed in the pupil by the ophthalmoscope lens. (3) Ophthalmoscope lens. (4) Image of the fundus formed by the ophthalmoscope lens. (5) Stereolenses. (6) Images of the fundus on the film in split-frame format. For anterior segment stereophotography the ophthalmoscope lens is removed and the anterior segment itself placed at 4. To prevent overlapping images a mask is placed at 4 to limit image size. In fundus photography the mask may more easily be placed over the ophthalmoscope lens.

with gratifying satisfaction of all required conditions to a set of solutions, one of which is described in the next paragraph. This particular solution also satisfies Thorner's conditions for orthoplasty.[1]

The inexpensive stereolens system (fig. 2) used to take the photographs for this article was made from a pair of unmatched, war surplus doublets having focal lengths of about 91 mm. One edge of each was ground flat to allow the optical axes to be placed 10-mm. apart. The lenses were glued in a simple plastic holder. Optical alignment was not attempted.

E. Operation

Operation is no different from that for ordinary photographs. Unless a special stereofocusing system is incorporated, one will focus on both images seen side by side. With the new Ihagee Stereo Binocular Viewfinder one can see the image in three dimensions for focusing.

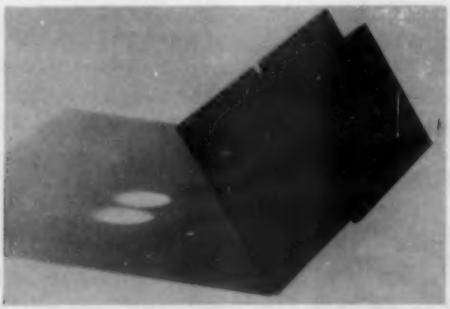

Fig 2. (Drews). Stereolens unit.

F. Results

With this technique stereophotographs of both the fundus and the anterior segment (fig. 3) can be made as easily and as reliably as ordinary electronic flash photographs. The relatively poor photographs used to illustrate this article were made with inferior lenses, poorly aligned, and are intended only to demonstrate the feasibility of such a stereosystem.

G. Summary

Single exposure stereophotographs of both the fundus and the anterior segment have been made with the electronic flash fundus camera described in Part III of this series of articles. Split-frame format has been used so that photographs can be made simply by exchanging a stereolens for the regular camera lens and adding a mask to the system. Such stereopictures can be filed in ordinary 35-mm. mounts and can be shown with an ordinary projector fitted with a stereolens. From such photographs it would be possible to calculate the differences in depth of various portions of the fundus.

Fig. 3 (Drews). Stereophotographs of the fundus and anterior segment. Masks were omitted for the fundus photograph, the images being allowed to overlap. The poor image quality and bad alignment are ascribable to the inferior quality of the lenses used and inaccuracies in gluing them together.

General summary

A series of four articles has been published showing how electronic flash can be successfully adapted to fundus photography. The work presented has been limited to clinically useful procedures and I have avoided more complicated techniques such as infrared and ultraviolet, cataract, and motion-picture photography. A flicker-flash type power supply has been employed and the flash tube mounted in the camera on the optical axis without intermediary optical systems. I have successfully employed this arrangement in an adapted carbon-arc camera and in a new fundus camera. The new camera can be quickly and easily converted to anterior segment photography and to single exposure stereophotography of either the fundus or the anterior segment. High resolution black and white photographs of the fundus have been made with a narrow band filter, taking advantage of the high efficiency and brief duration of the electronic flash. Exposure time with the unit described is about 1/3,000th of a second. Operation of electronic flicker-flash fundus cameras is unusually simple. They are capable of uniformly excellent color photographs.

Further considerations

An electronic flash tube has been fabricated in the proper size and shape and mounted directly where needed in an optical system, instead of having its light projected in by means of a supplementary optical system. The flash tube has a power supply which not only makes it flash in the usual manner but also makes it flicker rapidly at a low intensity when desired. It should be noted that this combination of principles has many other applications, such as corneal placidography and reflectography, photomicrography, photobiomicrography, macrophotography, endography, photo-elastic stress analysis, and so forth. With slight modification these principles can be used for motion-picture photography. Indeed this system can be applied wherever the use of electronic flash's instantaneous, cool, brilliant light has been desired but has not been possible because of the necessity of focusing, composing, adjusting lighting, determining exposure, and so forth, with the same light source that is used to take the picture. This system then allows qualitative and quantitative prediction and control of the photographic effect of an electronic flash light source mounted directly where needed in an optical system.

7361 Cornell (5).

Patents pending.

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DIAMOX TO PREVENT HYPHEMA AFTER CATARACT EXTRACTION*

A NEGATIVE REPORT

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Wound reopening and hemorrhage into the anterior chamber and in some cases into the vitreous, following cataract extraction, continues to be one of the most infuriating, depressing, and, on occasion, alarming of complications that occur in an otherwise smooth postoperative convalescence. It occurs between the third and sixth day, usually in my experience early in the morning of the fifth day. The patient is awakened by a sudden sharp and severe pain and knows at once that something very serious has happened to his eye. On dressing it, we almost always see bright fresh blood in varying amounts staining the eyepad. When the eye is opened, blood in varying amounts is seen in the anterior chamber. A close inspection of the wound reveals it to be edematous and congested, and the conjunctival flap boggy and raised. Fortunately, in most cases the blood slowly absorbs, and the visual result in the end is apt to be very good. In others, various complications that are the direct result of the accident, such as iritis, blood-staining of the anterior hyaloid and sometimes of the cornea, secondary glaucoma due to blockage of the filtration angle, and prolapse of the iris appear.

In the more severe cases, blood is found in the vitreous as well, and it may remain, slowly absorbing, for a month or more. In some of these cases, also, blood may be driven back in the root of the iris and produce an iridodialysis, or even a cyclodialysis. Occasionally blood can be incarcerated beneath the anterior hyaloid of the herniation of the vitreous.

In a relatively few cases, not studied here, there is a late subchoroidal hemorrhage that no doubt would have been expulsive had not the wound held for the most part. Eyes with this complication are almost always lost. If the condition can be recognized very early, it is possible to rescue such an eye from total loss by a scleral puncture and evacuation of the subchoroidal blood, but such a dramatic success must be exceedingly rare.

In a study of hyphema occurring in approximately seven percent of 1,185 cases of cataract extraction reported by me in 1941, the following conclusions were reached:

1. Hyphema is the result of wound re-

* From the Department of Ophthalmology, Northwestern University Medical School. Presented at the 92nd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1956.

opening and the rupture of newly formed corneo-episcleral blood vessels at the section. In a few cases it results from rupture of diapedesis from diseased iris vessels, as a result of inflammation. In this event it is apt to be recurrent.

2. In many instances, direct trauma is the chief cause of the rupture. In approximately 50 percent of the cases, no such history can be obtained. Likewise there are many cases on record in which severe and often direct trauma did not produce hyphema.

3. The theory is advanced that an increase of intraocular pressure or an overfilling of the anterior chamber produces a "constitutional moment" when even the slightest lid pressure would be a sufficient increment to cause the wound to reopen.

4. The "constitutional moment" occurs between the third and sixth postoperative day.

5. Hyphema and iris prolapse have an incidence of inverse ratio. The iris acts as a tampon on the ruptured newly formed vessels.

6. In approximately eight percent of cataract extractions (all sources) hyphema develops.

7. The cause is entirely local. Constitutional factors, including diabetes, probably play no part.

8. Hyphema is rare in purely corneal section, the healing of which is avascular. (On the other hand, delayed reformation of the anterior chamber, with its own set of complications, is more commonly seen.)

9. The type of operation (intra- or extracapsular) has no influence on the incidence of hyphema.

Since the writing of this paper, a number of excellent studies of several large series of cataract operations have been reported, notably by DeVoe,[2] Philips,[16] Owens and Hughes,[15] Sedan,[18] Legrand,[13] Dubois-Poulsen and Cragné,[3] and de Saint Martin.[17] These have supported, in the main, most of the above conclusions. These authors agree that the hemorrhage comes from the wound in most cases, and between the third and sixth day. The age and sex of the patient, the state of the weather, blood pressure, blood clotting mechanism, vitamin-C deficiency, focal infection, syphilis, diabetes, unless uncontrolled or severe, the type of the operation, and the use of adrenalin have no bearing on the problem. Good suturing of the wound is probably an important factor in prevention, although older statistics, where sutures were not used, do not support this premise too well. Iridectomy may play a slight role. Loss of vitreous is significant. A deep corneoscleral incision with conjunctival flap probably shows a higher incidence of hyphema than does an incision more purely corneal. Trauma plays a most important role, whether it occurs outside of the dressing, as from a bump or blow, or when it occurs beneath the dressing, as from tight closing of the lids or contracture of the extraocular muscles. Freedom of movement and the use of the unoperated eye after the third day may be a factor.

DeVoe remarked that the incidence of hyphema reported in the literature varied from one to 35 percent, and therefore such figures are not too reliable. In his series of 453 there were 20.9 percent of cases of postoperative hemorrhage into the anterior chamber and vitreous. Owens and Hughes reported an incidence of 9.3 percent out of 2,086 cases, Dubois-Poulsen et al. (649 cases) 32 percent, Barraquer (1,000 cases) 9.1 percent, Sedan (1,382 cases) 23.9 percent, Philps (374 cases) 13.1 percent, and de Saint Martin (868 cases) 11.1 percent. If we combine all of these figures compiled by excellent observers, we find that out of 8,897 cases of cataract extraction there is an incidence of 15.8 percent. This figure may or may not be of value to us for comparison.

The "constitutional moment" that occurs between the third and sixth postoperative day deserves more study. As far back as 1914, Claud Worth,[24] in discussing Treacher Collins's paper on postoperative complica-

tions of cataract extraction, said that hemorrhage into the anterior chamber usually occurred, if at all, five days after the extraction had been done. In the cases in which he had seen that happen, it occurred almost exactly 120 hours afterward, and he thought that was peculiar to the operation of the conjunctival flap; he had not seen it in cases in which the incision had been corneal. He thought that hemorrhage must come from the vessels which Mr. Collins had demonstrated as growing down from the conjunctival flap. He thought it must be produced by some movement on the part of the patient, not necessarily a blow, but some strain, such as squeezing of the lids, which caused a partial opening of the wound, and a rupture of some of these vessels at a stage when they had grown sufficiently to bleed, but were unable to resist a little violence.

A study of the healing process and timetable of an incised wound helps us to visualize what is going on, and is of great importance in giving us some clue as to the problem of the "constitutional moment." Many such studies have been done for us, notably and most recently by Dunnington and Regan.[4] Our present knowledge has been well expressed by G. B. Kara,[11] who reported on the histologic appearance of a human eye four days after cataract extraction, in which his findings confirmed those reported in the monkey eye by Dunnington and Regan.

The healing process in cataract incisions begins anteriorly and proceeds posteriorly. Wounds covered by a conjunctival flap are first sealed by a fibrovascular plug from the surrounding episclera, the plug filling the outer half of the incision by the end of the second day; proliferation of endothelium begins after the fifth day. In the absence of a flap, corneal epithelium surrounding the incision proliferates to form a plug, which first bridges the anterior surface and then extends into the lip of the wound. Healing is firm in 10 to 12 days and is supposedly complete by the end of the third week. Abnormalities in wound closure are overlapping, anterior gaping, and posterior gaping. Improper placement of sutures may predispose to any of these abnormalities. Superficial sutures may result in posterior gaping, which, in turn, may produce tissue inclusion. Deep sutures predispose to necrosis of surrounding tissue, epithelial downgrowth, and excessive fibroblastic proliferation.

Kara concludes his important study by the following remarks:

1. Wound healing at the limbus began by fibrovascular proliferation and anterior epithelization. 2. Epithelization and inflammatory reaction occurred around chromic absorbable surgical sutures. 3. Despite the use of appositional sutures, there was posterior gaping of the wound. 4. There was evidence of considerable trauma, namely, detachment of Descemet's membrane and hemorrhage around the major circle of the iris. 5. Necrosis of the sclera was produced by the suture.

We learn from this observation, and the experimental work on ocular wound healing in the case of a conjunctival flap reported in the literature, that the third to seventh day is the time when the fibrovascular plug from the surrounding episclera begins to soften or change as the proliferation of newly formed blood vessels and fibroblastic activity increase. The stage is thus set for the wound to give way, particularly where there is posterior wound gaping, tear across the new blood vessels, and lead to hemorrhage into the anterior chamber.

The second and active factor in the production of wound rupture is the compression of the eyeball by the orbicularis, the external ocular muscles, and in some cases external violent forces raising acutely the intraocular pressure to a point where the wound more or less gives way. There is, no doubt, some compression of the eyeball by the orbicularis and ocular muscles going on daily from the time of the operation. Prior to the third postoperative day, such external compression may and no doubt does open the wound a little from time to time, but no hyphema occurs because the new vessel development has probably not progressed as yet to any extent. When this proliferation is completed, there is a "constitutional moment."

Gradle and Sugar[9] advocated an extensive tenotomy of the orbicularis to prevent its action during the postoperative danger period. This procedure gave excellent results in 40 private patients, whereas in 52 clinic patients the results were approximately the

same as in a series of nontenotomized cases. My father, Derrick Vail, Sr.,[21] in 1915 practiced tenotomy of the orbicularis muscle to prevent the interference with healing of the wound by "involuntary winking, twitching movements, distinct fibrillary and cramplike contraction of the orbicularis palpebrarum muscle," and he reported prompt relief from a delayed formation of the anterior chamber by this method. Along this same line, Sedan, Franceschetti,[8] Stallard,[19] and de Saint Martin advocated the injection of the orbicularis with alcohol and believe that by this method the incidence of hyphema in their practices has been significantly reduced.

Thus, if the orbicularis and ocular muscles could be paralyzed for about a week following the operation, it would logically have a not inconsiderable effect on the incidence of hyphema.

But I do not think that the "constitutional moment" has as yet been satisfactorily explained. In 1933, and again in 1941, I[22, 23] advanced the theory that this moment occurred when the intraocular pressure began to come back to normal or even temporarily to be in excess of normal (overfilling and deepening of the anterior chamber which I have observed) as the formation of aqueous, partly depressed by surgery, began to resume its activity, and also when the wound, which might be slightly leaking up to that time, closed over completely. Thus, an increase in the intraocular pressure occurred that stretched the healing wound, producing a sensation of discomfort to the patient, who then voluntarily or involuntarily squeezed his eye by contraction of the orbicularis, and thus produced a wound reopening with hyphema.

Now this is an attractive theory, and I am loath to abondon it. It was based, I confess, on most inadequate grounds, for, obviously, tonometric studies during the first 10 days following cataract surgery are not to be entered into lightly. The Souter, or spring, tonometer, is safer for this purpose, but is far less accurate than is the Schiøtz. However, because the observations (Hilding, 1955[10]) were so few, and the unreliability of the Souter tonometer readings is most probable, I prefer not to pursue further this phase of the subject.

Orville Gordon, of the Department of Ophthamology, Northwestern University Medical School, is at present engaged on a tonometric study of eyes operated on for cataract. I am most grateful to him for allowing me to use some of the data of the results of his experiment so far. These data are as yet incomplete, and the conclusions uncertain, still, since this is apparently the first serious study of ocular tension of an eye that had a cataract extraction, from the third to the 10th day, it has considerable interest for us.

Seventy eyes were studied and tonometric readings were taken daily from the third postoperative day (65 cases) to the 10th postoperative day (58 cases). The ocular tension varied from less than 8.0 mm. Hg (assumed to be 6.0 mm. Hg) at the lowest to 26 mm. Hg at the highest. The average readings for the whole series were as follows:

Postoperative Day	*Number of Cases*	*mm. Hg*
3	65	11.3
4	70	11.8
5	70	11.5
6	70	11.8
7	67	11.6
8	68	11.7
9	60	11.1
10	58	10.9

The highest readings were as follows:

Postoperative Day	*Number of Cases*	*Highest Readings Percent of Cases*
3	14 (49)	28.6
4	14 (70)	20.0
5	8 (69)	11.5
6	13 (68)	19.1
7	11 (67)	16.4
8	6 (67)	8.9
9	3 (61)	4.9
10	3 (58)	5.1

These figures suggest that the highest ocular tension would occur between the first and third postoperative day, the next highest occurring on the sixth day, with a gradual decline beginning on the eighth day.

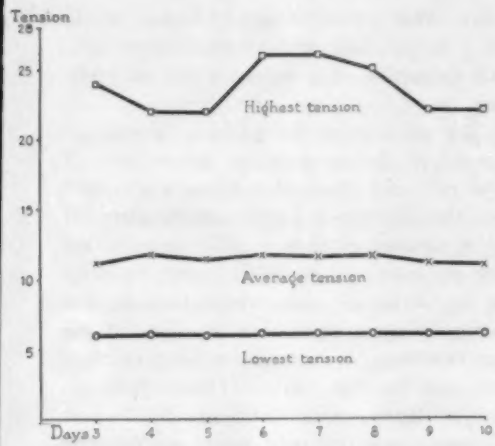

Fig. 1 (Vail). Average tonometric readings from third to 10th postoperative days. (Source: Experiments of Orville Gordon, Department of Ophthalmology, Northwestern University Medical School.)

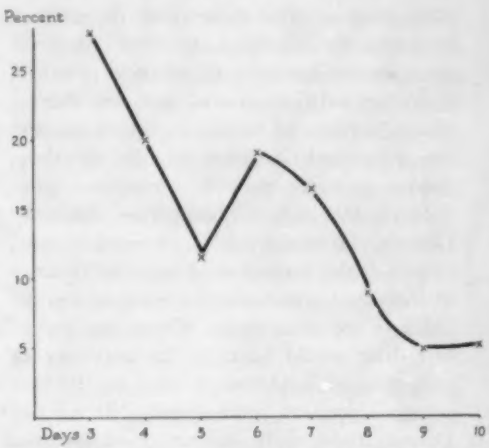

Fig. 2 (Vail). Highest tonometric readings during 10 postoperative days. (Source: Experiments of Orville Gordon, Department of Ophthalmology, Northwestern University Medical School.)

This may be so, but there are not enough data to make it significant.

According to Custodis,[1] Elschnig thought that the anterior chamber hemorrhage is a result of the changing regulation of the intraocular pressure during the postoperative phase. "We have convinced ourselves," says Custodis, "that Elschnig's opinion is more than a mere hypothesis. If patients from the second to the 10th day after surgery are examined on the ophthalmometer one finds that the inverse astigmatism increases during these days." In addition he measured the ocular tension in a "large number of patients" from the second day on. In the first few postoperative days the ocular tension was low, between 4.0 and 12 mm. He divided his patients into three groups: (1) those in whom there was a constant low pressure to the eighth, ninth, or even after the 14th day; (2) those in whom there was a gradual increase in the pressure curve, reaching the original pressure after the eighth postoperative day; and (3) a minority, in whom variations of between six and 10 mm. Hg were present from the third to fifth day.

He concluded that those patients who show variations in the intraocular pressure, or a slowly increasing value of pressures during the postoperative days, have a greater tendency for chamber hemorrhages than the patients who have always shown low values of intraocular pressure. He also makes the interesting suggestion that the diurnal rhythm of blood pressure and intraocular pressure may have something to do with the "critical movement."

In Orville Gordon's cases there were 10 hyphemas, or approximately 14 percent. Four of these occurred in the low pressure group (less than 8.0 mm. Hg), three at the time when the pressure was between 8.0 and 15, and three at the time when the pressure was between 15 and 22.

Recently, A. C. Hilding studied the ocular tension in 134 eyes from the 12th to 65th day after cataract surgery. There was a slow and steady rise in ocular tension from 8.0 to 22 mm. Hg on the 35th day and then a slow drop to 20 mm. Hg to the 65th day. He found that "postoperative hypotony following cataract extraction is still present after the 12th day so regularly that it is the rule and is to be expected."

Obviously, much more work on the intraocular pressure following cataract extraction must be done, for we actually know very

little about it. The theory that in cases of hyphema the "critical moment" depends upon the postoperative variation in pressure, if it does exist, associated with the diurnal phasic rhythm of intraocular pressure and the associated variation in the episcleral venous pressure, remains attractive.

Since the carbonic anhydrase inhibitor, Diamox (Acetazolamide), is widely used to inhibit the formation of aqueous in cases of increased intraocular pressure, it was decided to see what effect, if any, the use of this drug would have on the incidence of postoperative hyphema. A total of 100 consecutive patients were given 250 mg. of Diamox twice daily, beginning on the third postoperative day and continued through the eighth day. Twenty-four of these patients had hyphema. Two of these were due to obvious severe external force. As a control, 17 percent in a series of 120 consecutive cataract extraction cases that had been performed in the immediate previous period, in which Diamox had not been given, showed hyphema.

At about the same time, 26 patients on the service of John Bellows, Cook County Hospital, Chicago, were given Diamox in the same dosage and for the same period of time. Five of these had hyphema (19 percent).

John H. Dunnington gave Diamox to 30 patients following cataract extraction. Four of these had hyphema. In 30 control cases three had hyphema.

From these three series of cases, it can be concluded that Diamox has no effect in reducing the average incidence of hyphema after cataract extraction.

This, however, does not help us very much in our study of the "critical moment." Friedenwald[7] reported that, "if for any reason the flow rate before the administration of the drug (Diamox) is at a sufficiently low level, the drug will be ineffective in still further reducing the flow." Since tonometric studies were not done on these cases where Diamox was given, we do not know what effect, if any, Diamox would have on the daily ocular tension after cataract extraction. It is indeed a difficult problem.

The solution of the problem is not advanced at the moment by the reports of Thorpe[20] and others that Diamox will hasten the restoration of an empty chamber after cataract extraction. This premise has not yet been completely accepted. In three of my series of cases where Diamox was routinely used, there was late loss of the anterior chamber, as against four cases in the non-Diamox series. Dunnington reported three cases (out of 30) where Diamox was routinely used, against two cases (out of 30) without Diamox.

In other words, late loss of the anterior chamber has occurred in spite of the routine use of Diamox begun prior to the onset of the empty chamber.

Thorpe explains the favorable event of the restoration of the anterior chamber by Diamox as the result of dehydration and change in the blood electrolytic balance. This causes a reduction of choroidal effusion and possibly shrinkage of the vitreous, thus permitting the leaking wound edges to come together. Murphy[14] expressed the idea, held by several others, that the quantity of aqueous passing through the leaking wound was diminished by the reduction in the rate of the formation of aqueous. In this event, epithelial and fibroplastic repair would proceed more rapidly. Friedenwald commented, "The mechanism of this favorable effect has not been elucidated. Possibly temporary suppression of aqueous flow may facilitate the closure of a leak in the surgical wound."

If this were so, then the incidence of hyphema after cataract surgery should be markedly lower after giving prophylactic doses of Diamox during the healing period. This study does not support this premise.

The regulation of the intraocular pressure during convalescence from cataract surgery may be a factor in leading to the "critical moment," but the problem is as yet unsolved.

Conclusions

1. Hyphema after cataract extraction, in spite of more careful wound closure than was done in the past, continues to be a postoperative complication that can be serious and is always alarming and depressing to the patient and his surgeon.

2. Good wound closure undoubtedly plays an important part in reducing the incidence of this complication. In doing wound closure, attention should be directed to preventing the posterior gaping of the wound. How this can be accomplished is still an unanswered question.

3. There occurs a "critical" or "constitutional" moment between the third and sixth postoperative days, when the new and growing blood vessels, an essential part of a vascular healing process, are torn across as the result of a reopening of the wound. In other words, the wound is ready for reopening.

4. The process of regulating the intraocular pressure during this period may be a part of the "critical moment." It is conjectured that, at the moment when the last leak of a wound has been closed, the eye becomes uncomfortable to the patient, and he either voluntarily or involuntarily forcibly closes his lids or moves his eye or both, even in his sleep.

5. In an effort to decrease the intraocular pressure by decreasing the formation of aqueous, and thus prevent this "critical moment" until the wound was more firmly healed, Diamox (250 mg. twice daily) was given to 100 patients for five days, beginning on the third day after cataract surgery had been performed. The incidence of hyphema occurring in this series was approximately the same as in a control series. Two other observers noted the same result.

6. Diamox did not prevent the late loss of the anterior chamber.

7. It is concluded, therefore, that Diamox has no effect in the prevention of wound reopening and hyphema after cataract extraction.

8. More studies must be directed to elucidating the cause or causes that lead to the "critical moment" in this condition. The influence of the rhythmic diurnal variations in intraocular pressure, the presence or absence of choroidal detachment and its time of disappearance when it is present in the first few days, changes in the epibulbar venous pressure, and the variation in the ocular tension of the fellow eye should be included in these studies.

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EVISCERATION*

Utilizing a steel-mesh capped hollow plastic intrascleral implant

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Inquiries have revealed that a number of excellent ophthalmic surgeons have never performed evisceration because it is desirable to make a pathologic examination of the eye, inability to find a satisfactory implant, and fear of sympathetic ophthalmia.

We propose to demonstrate that these objections are unwarranted and that from the standpoint of a more normal appearance and motility of the prosthesis, as well as the psychologic reaction of the patient, evisceration, where indicated, seems to be preferable to enucleation. Evisceration is surgically less traumatic than enucleation and there is less likelihood of atrophy of the orbital tissues, with consequent sinking of the upper eyelid. The six extraocular muscles are left undisturbed, thus preserving their usual anatomic and functional relationship and assuring more normal mobility of the stump.

With careful evacuation of the contents of the eye in evisceration, the ciliary body, iris, lens, choroid, and much of the vitreous body may be preserved for histologic examination. If the latter is done soon after evisceration and evidence of suspicious involvement of the uveal tissues even remotely suggesting sympathetic ophthalmitis is found, enucleation should probably be performed.

The tolerance of the orbital tissues to the implantation of synthetic plastic material has been studied since 1941[1] at which time solid plastic cylinders and spheres were employed following evisceration. Experiments conducted by Rosa[2] showed that a sphere is not the most appropriate shape for a scleral implant for several reasons. Due to contraction and atrophy, the sclera is brought into contact with the implanted sphere producing a rounded surface. Although good movable stumps may be obtained with spherical implants, their motion is poorly transmitted to the concave prosthesis, thereby preventing a good functional result. Furthermore, spheres, in order to be retained, usually should not exceed 13 mm. in diameter. This relatively small size of the implant frequently prevents

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the formation of a large movable supporting stump. The sphere may be larger if the cornea is retained.

Ruedemann[3] has had excellent results with only 10 failures in 200 cases, employing his modified Burch evisceration with retention of the cornea. Poulard,[4] however, used the "older method" of retaining the cornea only in cases of diminution of the volume or atrophy of the globe, where the sclera alone did not suffice to surround the sphere or ovoid with sufficient space to allow for shrinkage. King[5] informed one of us (C. B.) that of approximately 12 eyes he had observed in which the old Burch method of evisceration had been performed, seven required enucleation because, in spite of medication, these eyes were congested and painful. King attributed this complication to friction over the cornea, as well as to the possible fact that the patients had not been hospitalized or treated adequately while in Korea. The fact that Hughes[6] also reported necrosis of the cornea following the Burch evisceration with retention of the cornea, discouraged us from employing this technique.

To overcome the difficulties of a completely spherical implant, Rosa[2] developed an implant which is spherical on the posterior two thirds and flattened on its anterior surface, so that the retraction of the sclera produces a flat surface anteriorly. The motion of the prosthesis is increased when its posterior surface is also flattened because it impinges upon the flattened surface of the stump. This arrangement imparts more motion to the prosthesis than when the surfaces are rounded.

The original Rosa implant has been modified in that the flattened anterior surface of the implant is covered with steel mesh. Suture grooves have been added through which four double-armed braided white nylon (5-0) sutures are preplaced* (fig. 1). When

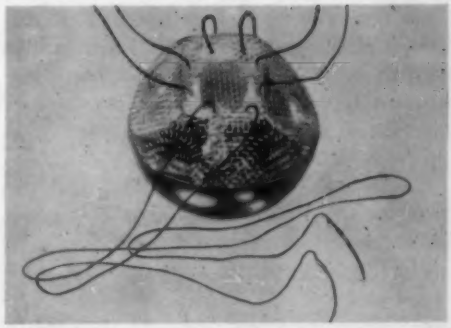

Fig. 1 (Berens, Carter, and Breakey). Hollow plastic implant with steel mesh cap and four preplaced double-armed 5-0 braided white nylon sutures.

the implant is inserted into the scleral envelope, the sutures are tied, thus assuring firm adhesion between the tissues and preventing rotation of the implant.

Extrusion of the earlier type of Rosa implant occurred in two cases reported by Gallo and Cuthbert,† respectively, who used the adult-sized implant in a case of a shrunken globe and a smaller than normal socket in which the scleral shell was too small to retain the implant. The implants are now made in the following dimensions:

Size	Diameter
Adult	18 mm. × 17 mm. × 13 mm.
Juvenile	16 mm. × 15 mm. × 11.5 mm.
Infant	14 mm. × 13 mm. × 10 mm.

The complication of sympathetic ophthalmitis was studied by deSchweinitz[7] who reported it in five of 317 patients (1.57 percent) in which the Mules operation had been performed. Poulard,[4] who inserted hollow glass spheres or ovoids within the sclera in 190 patients, reported that in no case did sympathetic ophthalmitis or even simple iritis develop. He stated that "the agitation caused by the spector of sympathetic ophthalmia has retarded the progress of eye surgery for a long time." Although Gifford[8] reported nine cases of probable sympathetic ophthalmitis after evisceration, Guyton[9] emphasized that "in the majority of the reported cases of sympathetic ophthalmitis following

* Implants made by the American Optical Company, Southbridge, Massachusetts. Sutures supplied by the American Cyanamid Company, Surgical Products Division, Danbury, Connecticut.

† Personal communication.

any form of eyeball removal, there are grounds for suspicion that this complication might have developed if no operation whatever were performed, or that it was already present in a clinically unrecognized stage at the time the eye was removed."

Gat[10] and Summerskill[11] both maintain that the danger of sympathetic ophthalmia is eliminated by proper evisceration technique. Since no case of sympathetic ophthalmitis was reported in the series of 200 cases by Ruedemann,[3] the 190 cases reported by Poulard[4] or in the series of 152 cases of evisceration using the Rosa-Berens implants presented in this paper (table 1), or 17 cases previously reported,[1, 2] the technique used by us is described in the hope that evisceration may receive the consideration we believe it deserves.

Indications for evisceration

1. Traumatic lesions of the eyeball, including intraocular foreign bodies and rupture of the globe.

2. Mild atrophy of the eyeball following trauma.

3. Chronic uveitis appearing in previously injured eyes or after intraocular surgery.

4. Mild chronic endophthalmitis.

5. Glaucoma secondary to uveitis or trauma in which surgery failed.

6. Inactive absolute glaucoma.

7. Buphthalmos.

8. Corneal and scleral staphylomas with glaucoma and disfigurement.

9. Eyes in which corneal ulcers have perforated.

10. Unsightly eyes, damaged from various causes.

Evisceration is contraindicated in the presence of sympathetic inflammation, malignant tumor of the eyeball, and absolute glaucoma when there is reason to suspect choroidal sarcoma. Evisceration is usually contraindicated in phthisis bulbi with marked shrinking of the eyeball and in advanced degeneration of the eyeball.

TABLE 1

Diagnosis in 152 cases of evisceration with intrascleral implant*

(Observed for from one to six years)

Diagnosis	No. of Eyes
Cornea, lacerated and perforated eyeballs	10
Cornea, ruptured	6
Corneal leucoma (pseudomonas aeruginosa infection in one)	3
Endophthalmitis	5
Glaucoma, absolute	6
Glaucoma, secondary—iris bombé	1
Glaucoma, hemorrhagic	1
Glaucoma, secondary	2
Glaucoma, bullous keratitis	1
Globe, ruptured	5
Globe, lacerated	20
Iridocyclitis, chronic with glaucoma	4
Panophthalmitis	20
Phthisis bulbi	7
Retinal separation and degeneration of globe	2
Trauma	15
Trauma, hyphema, secondary glaucoma	3
Ulcer, hypopyon	2
Ulcer, traumatic	1
Diagnosis not given in reports	38
Total	152

* Reported by ophthalmologists in the United States and Europe to whom Rosa-Berens implants were sent for trial, and including our private patients.

Technique for evisceration with intrascleral implant

A circumcorneal conjunctival incision is made close to the limbus and the conjunctiva is undermined to a depth of 5.0 mm. A cataract knife is passed into the sclera in the horizontal meridian, 1.0 mm. posterior to the limbus and the incision is carried upward (fig. 2).

The incision is completed with scissors, keeping in the sclera at least 1.0 mm. posterior to the limbus. Wedge-shaped pieces of sclera are excised with scissors to a depth of 1.0 mm. at the ends of the horizontal meridian of the incision (indicated by dotted lines in Figure 3).

All of the intraocular tissues are evacuated with a spoon and any remaining shreds of uveal pigment are carefully removed from the sclera. Scleral scars are excised and the edges of these wounds united with double-armed 5-0 braided white nylon mattress

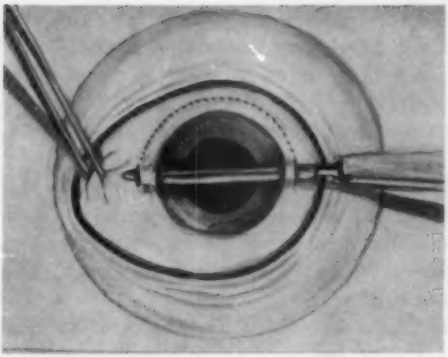

Fig. 2 (Berens, Carter, and Breakey). Scleral section 1.0 mm. posterior to the limbus is made with a cataract knife.

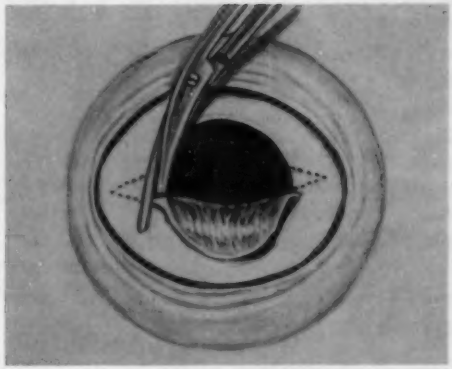

Fig. 3 (Berens, Carter, and Breakey). Completing excision of cornea with scissors. Dotted lines indicate triangular excision of the sclera at the horizontal extremities of the scleral wound.

sutures. The optic papilla is curetted to the same level as the surrounding sclera to prevent secondary irritation of the nerve by the implant. The scleral shell is carefully examined with an illuminated speculum.[12] Hemorrhage is controlled with a compressor[13] and adrenalin-soaked gauze placed within the scleral shell. Failure to control bleeding before inserting the implant may result in extrusion of the implant as reported by Hartmann.* He described a case in which the scleral sutures had cut through three days after surgery. A large blood clot was found behind the implant after its removal.

From six to eight double-armed, 5-0, braided white nylon sutures are looped through the superior scleral lip and are then passed through the inferior lip. These sutures are introduced 2.0 mm. from the scleral wound edge above, pass intrasclerally through both lips of the wound, and emerge anteriorally 2.0 mm. below the edge of the inferior lip.

A hollow, plastic implant of proper size to fit the scleral shell is inserted. The spherical surface is directed posteriorly and the longer diameter of the flattened anterior surface is placed horizontally. Two of the double-armed sutures which have been preplaced in the mesh are passed through the sclera at the ends of the horizontal meridian. The other two sutures are passed through the sclera at the ends of the vertical meridian, and tied securely on the outer surface. The mattress sutures which close the scleral wound are then tied. The conjunctival wound is united with a running, centrally locked 5-0 plain catgut suture (fig. 4-A). Small incisions are made with scissors 7.0 mm. from the sutured scleral wound, below, temporally, above, and nasally to facilitate

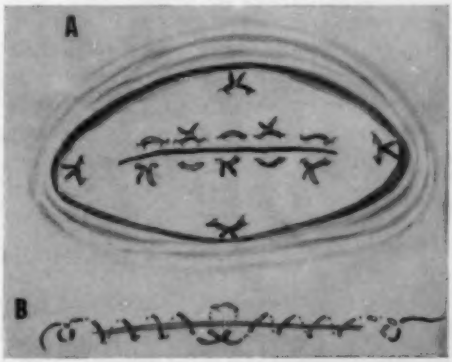

Fig. 4 (Berens, Carter, and Breakey). (A) Appearance of the scleral surface after the four preplaced implant sutures and the mattress sutures closing the scleral wound have been knotted and cut. (B) Conjunctival wound is closed with a centrally locked running catgut suture.

* Personal communication.

drainage of blood and serum. Antiseptic ointment and a pressure dressing are applied.

Operative complications

If hemorrhage occurs and is not easily controlled with pressure, the scleral wound may be opened with two forceps and epinephrine-soaked sponges packed into the cavity. If hemorrhage persists, the bleeding points may be cauterized with deliquesced crystals of trichloracetic acid.

Postoperative complications

Immediate expulsion of the implant may be due to the improper closure of the sclera. Braided 5-0 nylon sutures are recommended for best results. Delayed expulsion may occur if the scleral wound fails to unite because of improper closure, or from infection. These complications merely result in simple evisceration.

Report of cases

A total of 152 Rosa and Rosa-Berens intrascleral implants have been employed in the United States and Europe over a period of six years (table 1). In 100 cases, the original Rosa adult-size implant was used (without the steel mesh cap or suture grooves). The postoperative results in 87 of these cases were encouraging as reported by Drs. Hill, Town, Ponce, Lebensohn, Gill, Allen, and others.* Goar* said he noted no improvement in motility of the prosthesis over other implants he had used. This may be attributed to the fact that no instructions were given to flatten the posterior surface of the prosthesis to conform to the flattened anterior surface of the implant.

Four cases of extrusion of the earlier type of implant have been mentioned. A fifth implant extruded following severe intraocular hemorrhage which occurred on the third postoperative day. There was a marked mucopurulent discharge for several days after the extrusion. This was considered to be due to severe chemosis of the tissues following a retrobulbar injection of alcohol. Gat[10] avoided this complication by the use of ultraseptyl powder sprinkled into the scleral envelope after the contents had been removed.

No complications were reported in the 52 cases where the Rosa-Berens implant was employed, and no case of sympathetic ophthalmitis was observed in this entire series of 168 cases of evisceration studied for from one to 15 years.

Of the total of 152 cases reported in Table 1 (100 using the original Rosa implant and 52 using the modified Rosa-Berens implant), 139 cases had excellent vertical and lateral motility, very slight or no sinking of the upper eyelid, little or no discharge, and no operative or postoperative complications.

Summary and Conclusion

A study of the postoperative results and some of the postoperative complications observed in 100 cases, in which the original Rosa intrascleral implant was employed, stimulated the development of several changes in the implant and in the operative technique.

The modified Rosa-Berens hollow plastic intrascleral implant with steel mesh cap, made in adult, juvenile, and infant sizes, was used in 52 cases with gratifying results and with no postoperative complications.

In our series of 168 cases where intrascleral implants were employed and observed for from one to 15 years, 190 cases by Poulard, and in the 200 cases reported by Ruedemann, no case of sympathetic ophthalmitis was reported following evisceration.

It is hoped that more surgeons will employ evisceration because, when indicated, evisceration is preferable to enucleation. A suitable intrascleral implant is capable of providing an excellent stump which produces a more natural appearance of the prosthesis. The flattened anterior surface of the stump imparts excellent motility to the prosthesis if the posterior surface is flattened.

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* Personal communications.

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A STUDY OF 1,000 CATARACT EXTRACTIONS

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In some countries, Pakistan, India, and several countries in Africa, for example, there are remarkable opportunities and need for ophthalmic surgery. In some cases this surgery must be performed under conditions which by American standards might be considered somewhat primitive but still, in many instances, quite satisfactory results are obtained.

The present report of a series of cataract extractions performed in a mission hospital in Pakistan is presented (1) to acquaint American readers with the opportunities for ophthalmic surgery in some other countries (2) to present a comparison of the incidence of complications during and following cataract extraction by the intracapsular method and by the capsulotomy or so-called extracapsular method, and (3) to report the incidence of complications following cataract extraction without the use of sutures.

Since present-day training of residents in ophthalmology in the United States stresses the use of intracapsular methods with the use of corneoscleral or some other type of suture, it was felt that the data presented in this report might be of interest for purposes of comparison.

The 1,000 cataract extractions reported in this article were performed during a seven-month period, September, 1955, to March, 1956, in the American Mission Hospital, Taxila, Pakistan. The patients were mostly Pakistani village farmers some of whom had very little conception of cleanliness or sterility and little idea of what was expected of them in a hospital. Most of the operations (935 cases) were performed by one surgeon.

In this hospital patients are seen for the first time in an afternoon out-patient clinic and those having cataracts or other conditions requiring surgery are admitted. A urinalysis is performed; the patient's lids and face are cleaned; and a sterile pad is applied to the eye to be operated upon. Phenobarbital (1.5 gr.) is given the night before operation.

On the morning of operation each patient is given phenobarbital (3.0 gr.) and chlorpromazine (25 mg.). The patients walk to the operating room where the pad is re-

TABLE I

TYPES OF CATARACT

Type of cataract	Number
Immature	54
Mature senile	755
Intumescent	40
Hypermature	102
Morgagnian	9
Juvenile	12
Traumatic	11
Complicated	40

moved and examined. Those having excessive or purulent discharge have their operations postponed and are started on an antibiotic.

Pontocaine is used for topical anesthesia and the tension is measured. A Van Lint block is administered by a nurse and a retrobulbar injection of 2.0-percent procaine with hyaluronidase is administered by the surgeon. The lids are scrubbed with a 1:5,000 Zephiran solution, a speculum is inserted, and the conjunctival sac flushed with 1:5,000 Zephiran.

The incision is made with a von Graefe knife through the apparent corneo-scleral junction in the upper one half of the cornea. As the knife emerges superiorly it is rotated slightly so as to be more tangent to the globe. The incision is carried on up under the conjunctiva leaving an intact bridge conjunctiva 2.0 to 3.0 mm. wide and 6.0 to 8.0 mm. long. A basal iridectomy is performed in the 12-o'clock meridian. The lens is then removed either extracapsularly after a capsulotomy has been performed or intracapsularly. For the extracapsular extraction, the superior lip of the wound is depressed with a lens loop and the lens expressed by pressure applied below with a muscle hook. For the intracapsular extraction, the conjunctival bridge is elevated with a muscle hook and the capsule forceps or erisophake is applied to the lens under direct vision and the lens slid out under the bridge. The iris pillars are replaced as necessary and sterile sulfamezathine (or sulfanilamide) powder and penicillin ointment (25,000 units per cc.) are placed in the eye and both eyes bandaged.

Sutures are used only in selected cases—unusually unco-operative patients, mentally disturbed patients, those having chronic coughs which could not be adequately controlled, asthmatics, or those who feel for some reason that they cannot lie flat in bed. In this series of 1,000 operations sutures were used in only 37 cases.

The patients are carried back to their beds and are kept in bed for eight days. The eye is dressed every other day and the unoperated left uncovered after the first dressing. In some cases both eyes are operated upon on the same day. On a busy morning 40, 50, or 60 cataract operations may be performed. Patients are generally discharged on the ninth postoperative day. Those wishing glasses are advised to return to the hospital in one month for refraction.

Although exact statistics concerning the incidence of cataracts in Pakistan are not available, a suggestion of the incidence may be obtained from the fact that during the period in which these 1,000 cataract operations were performed 6,000 patients were seen in our eye out-patient department, roughly one cataract for every six patients coming to the hospital with eye complaints. It should be noted however that most of our patients are illiterate so a relatively small percentage of the patients come because of refractive errors.

The distribution of cataract types is shown by the data in Table 1.

TABLE 2

TYPE OF OPERATION PERFORMED

Capsulotomy		365
with capsulectomy		96
Intracapsular extraction		610
Lens forceps applied above middle of lens and lens slid out under intact conjunctival bridge	524	
Lens forceps applied below middle of lens and lens tumbled	41	
Erisophake extraction	34	
Lens forceps applied above middle of lens and zonule stripped	3	
Smith extraction, pressure only	8	
Burst capsules in all types of intracapsular extractions	50	
Vectis delivery- with lens loop		33
Linear extraction		12

TABLE 3

INCIDENCE OF COMPLICATIONS AND VISUAL RESULTS

	All Operations 1,000 Cases		Capsulotomy 365 Cases		Capsulotomy with Capsulectomy 96 Cases		Intracapsular Extraction 610 Cases	
Complication	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Vitreous loss								
one plus	22	2.2	11	3.0	1	1.0	8	1.3
two plus	11	1.1	5	1.3	2	2.0	5	0.8
three plus	4	0.4	2	0.5	0	—	0	—
*Total		3.7		4.8		3.0		2.1
Striate keratitis#								
one plus	317	31.7	95	26.0	34	35.0	218	35.8
two plus	79	7.9	22	6.0	3	3.0	55	9.0
three plus	9	0.9	5	1.3	1	1.0	4	0.6
Total		40.5		33.3		39.0		45.4
†Delayed formation of anterior chamber	70	7.0	13	3.6	7	7.0	57	9.3
‡Nonformation of anterior chamber	8	0.8	2	0.5	2	2.0	5	0.8
Cortex in AC								
one plus	50	5.0	47	12.8	7	7.0	2	0.3
two plus	16	1.6	14	4.0	2	2.0	3	0.5
three plus	4	0.4	3	0.8	2	2.0	0	—
Total		7.0		17.6		11.0		0.8
Capsule visible in anterior chamber	82	8.2	77	21.0	2	2.0	5	0.8
Iris prolapse	13	1.3	7	1.9	2	2.0	6	1.0
Infection	2	0.2	2	0.5	0	—	0	—
Choroidal hemorrhage	1	0.1	1	0.3	0	—	0	—
Conjunctival edema	8	0.8	3	0.8	0	—	5	0.8
Needling required	18	1.8	14	3.8	0	—	3	0.5
Bulging wound	8	0.8	4	1.1	0	—	0	—
Secondary suture of wound required	6	0.6	2	0.6	0	—	3	0.5
§U-shaped pupil	150	15.0	51	13.9	14	14.5	98	16.1
Boat-shaped pupil	5	0.5	2	0.5	0	—	3	0.5
¶Vision (of 912 cases)								
VG vision	841	91.9	295	87.3	82	91.1	537	93.4
CF vision	46	5.0	29	8.1	7	7.0	16	2.6
HM vision	19	2.1	13	3.6	6	6.0	6	1.0
LP only	6	0.7	1	0.3	1	1.0	6	1.0

* Of the 33 cases in which the lens was delivered with the lens loop, vitreous was lost in 11 cases.

† Delayed formation of anterior chamber indicates the anterior chamber was not formed at the first dressing but reformed (with only atropine drops) during the first nine postoperative days.

‡ Nonformation of anterior chamber indicates that the anterior chamber was not formed at the end of nine postoperative days.

§ Anything other than a keyhole-shaped pupil was considered a complication.

¶ Unfortunately a visual result is not recorded for every case, in some cases through neglect and in other cases because the patient having discovered that he was able to see satisfactorily left the hospital of his own accord without waiting for further examinations or for discharge.

Actual testing of postoperative visual results is in many cases difficult since 80 to 90 percent of the patients are illiterate. Consequently a rough classification of postoperative vision has been established with four classes of visual results:—

VG stands for "vision good" and indicates that the patient counts fingers at three to four feet with no doubt nor hesitation on the ninth postoperative day;

CF stands for "counts fingers" and indicates that the patient counts fingers at three to four feet but with some effort or hesitation;

HM indicates that the patient sees only hand movements; and

LP indicates light perception only.

The types of operation performed are shown in Table 2.

Table 3 compares the incidence of complications and the visual results obtained with three types of operation: Capsulotomy, capsulotomy with capsulectomy, and intracapsular extraction.

These figures indicate that the main differences in incidence of complications following intracapsular and extracapsular cataract extraction, in our hands at least, are:

1. Higher incidence of striate keratitis following intracapsular extraction (although in practically every case this had cleared entirely by the ninth postoperative day).

2. Higher incidence of delayed formation of the anterior chamber following intracapsular extraction (of the 57 cases of delayed anterior chamber formation following intracapsular extraction the anterior chamber reformed spontaneously in 50 cases).

3. Higher incidence of cortex in the anterior chamber following capsulotomy.

4. Higher incidence of visible capsule in the anterior chamber or pupil following capsulotomy.

These latter two complications apparently are the cause of the somewhat lower percentage of good visual results following capsulotomy as compared to the results following intracapsular extraction—87.3 percent versus 93.4 percent.

SUMMARY

A study of 1,000 cataract extractions performed over a seven-month period in a mission hospital in Pakistan is presented.

A comparison is made between the incidence of complication after intracapsular and extracapsular lens extraction and a comparison is made between the rough visual results following the two methods.

American Mission Hospital.

[‡] Since this paper was submitted for publication, the cause of this unusually high incidence of striate keratitis has been discovered and will be the subject of a subsequent report.

OPHTHALMOLOGIC HYDROSTATIC PRESSURE SYNDROME*

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Escape from military aircraft in flight by means of an ejection seat exposes the occupant to prolonged high decelerative forces which may be injurious or lethal at supersonic speeds. In experiments conducted by Stapp,[1] a rocket-propelled sled on rails, decelerated by a braking system that reproduces the forces encountered in supersonic escape from aircraft, has been used to determine voluntary tolerance limits of exposure on human subjects.

Criteria for tolerance are incipient reversible injuries, as well as the subjective evaluation. By this means it has been experimentally established that a human subject seated facing forward, exposed to deceleration perpendicular to the long axis of

* Presented at the 92nd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1956.

the body, can sustain a rate of onset of 1,500 G per second or less, a peak magnitude of 50 G, and total duration of forces higher than 25 G but less than 50 G of not more than one second. In two of the 76 human experiments accomplished to date, signs and symptoms suggestive of a syndrome have been found which correspond to those found in three cases of accidental exposure under widely different circumstances. In these five cases the syndrome is caused by high decelerative forces of abrupt onset applied from the rear to the front of the head while the blood vessels of the head and face are congested by high hydrostatic pressures.

Abrupt rise in intrathoracic pressure, due to (1) displacement of abdominal viscera against the diaphragm or (2) abrupt compression of the abdomen or lower chest, can be transmitted through the blood vessels to the head and face, causing rise of hydrostatic pressure. Simultaneous application of the decelerative force results in signs of cerebral concussion with confusion, retrograde amnesia, circulatory shock, temporary loss of vision, retinal hemorrhages, subconjunctival hemorrhages, ecchymosis of the eyelids, and periocular edema. The paranasal sinuses are congested and even hemorrhagic.

Similar fundus changes have from time to time been noted by other observers such as Purtscher,[2] who noted the appearances of hemorrhages, exudates, and edema after a compression type of injury to the trunk. Vogt[3] reported a similar case, except that the macular area was free from exudate, in contrast to one of the cases reported here. Other similar cases have been reported by Stokes,[4] and one similar case by Urbanek,[5] in which actual sections of the retina containing the white exudate were taken, revealing collections of transudated fluid.

Of these five cases, two are the first instances of producing this syndrome under experimental conditions in which the forces were measured, corroborating the findings in the supersonic bailout here reported. Two other cases confirm that the combined hydrostatic and decelerative force application described above produces the syndrome, rather than external wind pressures against the face which occurred to the pilot in the supersonic escape when his helmet blew off during ejection.

Experimental occurrence of syndrome

The first case of this syndrome occurred during experimental exposure to more than 25 G at 500 G per second rate of onset within a quarter of a second. Injuries were limited to petechial hemorrhages of the sclera, retinal vascular spasms, superficial retinal hemorrhages and signs of concussion manifested by severe frontal headache for 36 hours. This experiment was performed at Edwards Air Force Base in June, 1951. It consisted of a linear deceleration on a rocket sled with the subject seated facing forward, restrained by shoulder straps, lap belt, and inverted "V" leg straps, with the head bare and bowed as far forward as possible. The head swung through an arc of 55 degrees during deceleration. A windshield excluded windblast.

The second instance occurred during a rocket sled deceleration experiment in December, 1954 at Holloman Air Force Base. The subject was in the same position, and, in addition to the restraints described above, a chest belt was drawn tightly enough around the lower part of the thorax completely to stop rib movements in respiration. Head and face were completely enclosed in a protective helmet which was lashed to the headrest, limiting the forward motion of the head.

Exposure to an initial force of 35 G applied at a 600 G per second rate of onset was followed by a plateau of 25 to 27 G lasting for 0.4 of a second and a second peak of 40 G of less than 0.1 second duration followed by a plateau of approximately 25 G for the remainder of a total duration of 1.1 seconds.

Facial congestion was extreme, and eye

Fig. 1 (Lyle, Stapp, and Button). Subject of experiment 2 at 48 hours.

signs were: appearance of lateral subconjunctival hemorrhages which later became confluent, forming complete hemorrhagic blebs, along with periocular edema and hemorrhage; initial inability to see, then foggy light perception, with rapid clearing and ability to count fingers. Cerebral signs were not severe. The protective helmet excluded windblast from the head and face (fig. 1).

Occurrence of syndrome in supersonic escape

The third instance, in February, 1955, was incurred during escape by ejection seat from an aircraft (F-100) at a velocity of 1,160 feet per second at an altitude of 6,500 feet, with the craft in an 80-degree dive. G. S., the test pilot, was protected by helmet and visor until shortly after the exit. Shoulder straps were loose, and he was retained by his lap belt only during ejection. For the initial wind drag linear deceleration, the pilot was seated with his face on his knees, so that in addition to the compression of the lower abdomen with the lap belt and the setting up of a hydrostatic column from hips to head level, there was an impingement of the abdominal viscera against the diaphragm. This, and possibly other jolts to the abdomen prior to separation from the seat, resulted in traumatic perforation of the terminal ilium.

The patient was seen within an hour after the incident, and the head and face were extremely congested. Vision in both eyes was limited to counting fingers, and external examination revealed extensive periorbital ecchymosis. There were complete subconjunctival hemorrhages so extensive that no sclera could be seen, and there appeared to be a mild bilateral proptosis of the eyes, although no exophthalmometer readings, were available at the time. Both pupils reacted well to light and accommodation, and there appeared to be no abnormalities of the extraocular muscles. Both corneas and anterior chambers appeared to be clear. Fundus examination at the time revealed normal clear media with no involvement of the discs. There was a mild arteriospasm present, and a few small questionable hemorrhages in the periphery.

On the second day, a few retinal hemorrhages began to appear accompanied by cotton-wool patches. The first hemorrhages were small and flame shaped, but later the same day several round and one large subhyaloid hemorrhages appeared.

On the third day, the hemorrhages were more pronounced, with new ones occurring all the time. At this time a medical artist was called in, and complete fundus drawings were made, showing the extensive hemorrhages in both eyes. The large subhyaloid hemorrhages in the left eye are well illustrated in Figure 3, and they appear to be venous in nature, occurring along the branch of the superior nasal vein and superior tem-

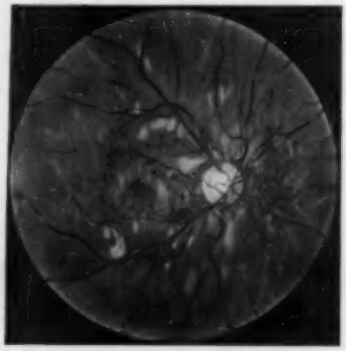

Fig. 2 (Lyle, Stapp, and Button). Test pilot G. S. at 48 hours, O.D.

poral vein. The edema patches and smaller hemorrhages are also well illustrated in this drawing. Figure 2 illustrates the many smaller hemorrhages and edema occurring in the right eye during the third day of hospitalization.

By the fourth day, the patient was able to read large print, but new hemorrhages were still appearing all the time, together with more generalized retinal edema, giving the macular areas a cherry red appearance.

On the fifth day, the patient's vision had improved to 15/30 in each eye, and the entire process appeared more stationary. During this entire period, the external appearance of the eyes remained much the same.

From the fifth day on, there was a continuous improvement in vision, with slow disappearance of the hemorrhages and exudates. No new hemorrhages appeared after this time, although the eventual clearing was quite slow, especially in the left eye. Figure 4 illustrates this, and represents a drawing of the left fundus about two weeks after the initial injury, still showing the extensive hemorrhages and edema patches. The last drawing, Figure 5, shows the left fundus six weeks after the injury. Here can be seen the organization of the nasal hemorrhage and the complete disappearance of the large temporal hemorrhage. Practically no retinal edema remains at this time. During the period immediately following the injury, and until three months later, there appeared to be a small central scotoma in the left eye identifiable with the 1/1,000 test object. Three months after the original injury, the patient's vision was 20/20, O.D., and 20/20—2, O.S. Color vision, stereopsis, biomicroscopy, and depth perception were all within normal limits.

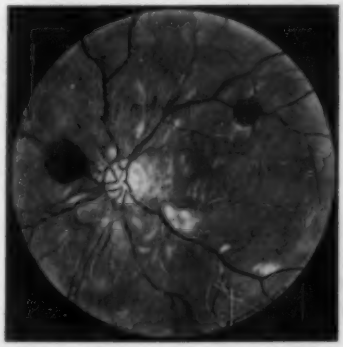

Fig. 4 (Lyle, Stapp, and Button). Test pilot G. S. at two weeks, O.S.

It has been estimated that this patient was subjected to 40 G for 0.31 seconds, and the patient's head accelerated to a peak of 60 G for 0.09 of a second, accounting for the severity of the retinal hemorrhages. This, plus the pooling effect on the vascular system[2] when the human body is subjected to great G forces, probably accounts for the signs observed above.

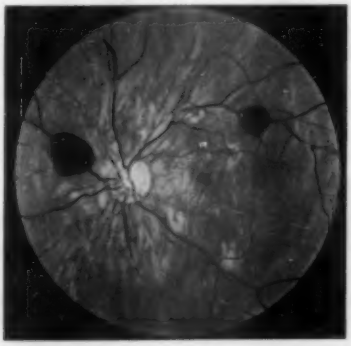

Fig. 3 (Lyle, Stapp, and Button). Test pilot G. S. at 48 hours, O.S.

Fig. 5 (Lyle, Stapp, and Button). Test pilot G. S. at six weeks, O.S.

Occurrence of syndrome in low velocity escape

The fourth instance, in March, 1955, occurred to Goodyear Company test pilot L. E. in an experimental flight in a sail plane, investigating the Sierra Wave phenomena near Bishop, California. At an altitude of 15,000 feet and an airspeed of 60 miles per hour, he entered an area of turbulence under a lenticular cloud formation. The left wing of the sail plane, stressed to 8.0 G, was violently sheared off near the cockpit in a downward direction. The tail section broke off next. The cockpit went into violent tumbling in an outside loop attitude. The pilot, in winter clothing, including winter flying boots, was thrown upward, forward, and to the left with such violence that the left shoulder strap (1,500-pound tensile strength) was broken, and the canopy was knocked off by his head. He wore a crash helmet. Apparently his feet were caught in the rudder pedals by the winter flying boots. He reported temporary loss of consciousness, apparently related to the stunning blow against the canopy, and did not recall the subsequent violent tumbling gyrations. Eventually he was able to pull the ripcord of his parachute. He was aware of loss of vision lasting about 10 minutes, from the time the wing sheared off until he was able to see his wrist watch again during the parachute descent. Vision returned to the left eye first, and to the right eye two minutes later. He came to earth with no further injury. His boots were found still stuck in the rudder pedals in the wreckage of the cockpit.

Physical examination showed severe contusions of shoulders and hips on strap impingement areas, periocular congestion, subconjunctival hemorrhages, mild signs of concussion, and mild circulatory shock at the time of the first examination. There were, however, no signs of retinal hemorrhages. Recovery was complete and uneventful in three weeks. Tumbling with an axis of rotation through the feet resulted in high negative G, and resultant hydrostatic pressure rise in the subject's head. The low speed of unpowered flight precluded windblast as a factor.

The fifth instance of this syndrome occurred during a takeoff crash of an F-84F jet in August, 1955, in which the pilot either intentionally or accidentally ejected himself through the canopy. The aircraft, at stalling speed, struck and broke four power lines at a height of between 38 and 52 feet. In succession the aircraft struck a house, a 24-inch diameter pine tree, and a second house, in a path 326 feet beyond the first impact. At some point along this path the pilot ejected through the canopy. The seat collided, footrest first, with the base of a tree, coming to rest six feet from this final point of impact. The pilot was found in the ejection seat lying on his right side, at a point 347 feet from where the aircraft struck the ground. The pilot was conscious, but in a state of shock.

Injuries included fracture of all four extremities and a head injury, the latter consisting of cerebral concussion and contusion with retrograde amnesia, a mental confusion and transient disorientation. The pilot has referred to a normal take off roll, but it is not determined if this refers to the flight in question or to a prior flight. Memory is clouded and unreliable to about 48 hours prior to the accident and there is still considerable confusion.

The initially observed dusky flushing of the face, appearance of lateral subconjunctival hemorrhages which later became confluent, forming complete hemorrhagic blebs, along with the periocular edema and hemorrhage; also the petechial hemorrhages and bruises from shoulder straps; also the inability to see then foggy light perception, with rapid clearing and ability to count fingers—all these bear a striking and fascinating similarity to the sequence described by Colonel Stapp in his experiments with abrupt deceleration at Holloman Air Force Base.*

Discussion

Dr. Donald J. Lyle: My contribution to this presentation is extremely meager. I first met Colonel Stapp and examined his eyes a number of years ago, when he was stationed at the Aero Medical Laboratory, Wright-

* Reported by Major Leiter, USAF (MC) Flight Surgeon.

Patterson Air Base, Dayton, Ohio. At that time he was engaged in crash experiments to determine the limit of human tolerance, using rocket sleds.

In the experiment resulting in retinal hemorrhages, he had decelerated from 154.8 m.p.h. to 34.4 m.p.h. in 31.2 feet with measured force of 46 G. There was no blackout or grayout at the end of the run. Retinal vascular spasm was evidently present, followed by retinal edema and serous exudates and, within four hours, by fogging of vision in both eyes. The next day dimness remained in the right eye, with paracentral and peripheral scotoma. The vision in the left eye had cleared, although a peripheral hemorrhage producing scotoma existed. This history was obtained, and examination made, at the time, and immediately following the experiment. One month later, when I first saw the condition, the hemorrhages were still present. Vision at that time, corrected, was 20/20 in each eye. The scotomas persisted, with slight annoyance to vision in the right eye.

Colonel Stapp was last examined by me about a year ago, at which time his corrected vision was 20/20 in each eye. The scotomas were still present but were clearing with rapid improvement, following the last experiment, when he was projected 632 m.p.h., stopping in 1.4 seconds. However, Colonel Stapp confided in me that he could not conscientiously recommend this procedure as routine treatment for retinal hemorrhage or residual scotomas.

One might possibly expect, after 29 experiments, brain damage such as is found in a "punch drunk" pugilist. The contrary is the case, as any one can testify after a few minutes' conversation with Colonel Stapp.

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THE RELATIONSHIP OF FIELDS OF VISION TO SAFETY IN DRIVING*

With a report of 680 drivers examined by various screening methods

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Introduction

On looking into the literature of the relationship of fields of vision to safety in driving, many opinions were encountered but I found no comprehensive report of controlled research on a large number of drivers. It was, therefore, thought worth while to write a pilot paper indicating the many facets of the problem, any one of which could be pursued later in more detailed fashion.

Driver's Bureau questionnaire

As a beginning, it seemed advisable to get the views of the administrators of the

* An abridgement of a thesis presented for membership in the American Ophthalmological Society and published in the *Transactions* of the American Ophthalmological Society, volume 54, 1956. Prepared in co-operation with the University of Colorado School of Medicine and the Driver's Licensing Section of the Motor Vehicle Division of the State of Colorado.

driver's licensing bureaus of the various states by sending out an extensive questionnaire.† Of the 48 mailed, 33 were returned. A three to one majority said there was little, if any, proof that visual defects had any definite relationship to accidents.

The most interesting feature was the answer to the question as to whether any case was known in which defective fields had been the major cause of an accident; only two of the 33 answered "yes." Their answer also agreed with the opinion of Cleeton that 80 percent of all automobile accidents are due to driver failure and 20 percent to all other causes, such as defects in cars, roads, illumination, and visibility. Driver failure includes faulty attitude, judgment, attention, concentration, knowledge, and physical defects of all kinds.

Standards

Attention should be called to the comprehensive survey published yearly by the American Optical Company on the state requirements for motor vehicle operators. It is there reported that nine states have visual field testing requirements. However, my own information from state administrators (already referred to) indicates that eight more states do field examinations on certain special cases. Burnett, who supervises the preparation of the American Optical Company report, says it is his impression that the so-called "requirements" are usually only screening tests to refer drivers for more complete examination. All the states except one (Colorado) examine in the horizontal meridian only and usually only temporally.

The Administrator's Manual says that a temporal limit of 60 degrees is a definite handicap. The American Medical Association Committee recommended a form field in the horizontal of not less than 45 degrees to both sides laterally from the field of fixation. The American Optical Survey reports a variation in standards for total field from 90 degrees in Vermont to 150 degrees in Mississippi. The military ruling is that contraction of 15 degrees in any meridian disqualifies. The international rules are given as 70 degrees for a three-degree object.

Theoretic discussion of fields

Fields of vision instead of *field* of vision was employed in the title of this paper to accentuate the fact that there are various fields of vision. There is the ordinary *normal* field taken with the eye in the primary position which is composed of the *macular, central,* and *peripheral* fields. Traquair says "the ordinary field is often called the *relative* field, in contrast to the *absolute* or *maximum* field, which is obtained when the eye is fixed and the face turned during the examination of each meridian in such a way as to exclude the influence of the orbital margins." That this maximum field superiorly and inferiorly increases only slightly with movement is, I believe, due to some peripheral amblyopia of the field from lack of use. Temporally it is increased only 10 degrees.

Therefore, with relationship to the "primary position of the driver and car," the temporal field is 110 degrees if the eye is moved 10 degrees temporally, but with reference to the optic axis of the eye, the field is still 100 degrees.

We may speak of the primary position of a driver as straight ahead of his position in the car, just as one speaks of the primary position of the eyes as straight ahead. Thus, if we move the eye 40 degrees more to the limit of rotation, the temporal *driver's field* remains at 110 degrees, because 40 degrees of the nasal field is borrowed to make up the difference. However, in this position the temporal "eye field" is only 60 degrees (100 − 40). On the nasal side the eye field begins to be cut as soon as the eye is turned nasally, but again the driver's field borrows

† Anyone wishing to peruse this or other questionnaires reported in this paper may obtain them from the library of the State Highway Department, 4201 East Arkansas Avenue, Denver, Colorado.

TABLE 1

PRACTICAL UNIOCULAR FIELD OF VISION, WITH REFERENCE TO THE PRIMARY POSITION OF THE DRIVER

Static (relative or normal) Field to Same Side as Turning	Position of Eyes, Head, and Body					
	Eyes Move Also	Total Field with Moving Eyes	Head Moves Also	Total Field (static+eye and head movements)	Body Moves Also	Total Field (static+eye, head and body movements)
Temporally						
100	50	110*†	60	170	40	210
Nasally						
60	50	60*	60	120	40	160
Superiorly						
60	40	60*	45	105	30	135
Inferiorly						
75	50	75*	45	120	30	150

* Limited by orbital margin.
† Only on the temporal side does the eye movement add to the practical field.

from the temporal field. Referring then to Tables 1, 2, and 3, one can see that the total eye field of one eye is the greatest when the eye is turned 10 degrees temporally and the least when turned to the limit on either side, especially nasally.

The variation in the instantaneous *binocular* "eye field" is just as striking, for the temporal field of the left eye looking 50 degrees temporally is 60 degrees and the temporal field of the right eye looking nasally is 100 degrees, making a total 160 degrees as compared to the 200 degrees, in the primary position (table 2 and fig. 2). The total is 220 degrees only if *two* maximum positions are added. A fact, somewhat overlooked in our surgical rationalization of unilateral cataract removal, is that the limits of the bilateral field (200 degrees) are not greatly different from those of the unilateral field (160 degrees). This small 25-percent increase can be seen in textbook diagrams.

Why then do we get the sensation of increasing our peripheral field by turning our eyes to the side, when really the fields are less? Apparently it is an illusion because of the relative clarity of the macular and central field which is substituted thereby for the less

TABLE 2

VARIATION OF TOTAL UNIOCULAR FIELD IN ECCENTRIC POSITIONS

Nonprimary or Eccentric Position						Primary Position Eyes Straight Ahead			Nonprimary or Eccentric Position					
50° Temporal (Limit of rotation)			10° Temporal						10° Nasally			50° Nasally		
T	N	Total	T	N	Total	T	N	Total	T	N	Total	T	N	Total
60	70	130	100	70*	170	100	60	160	100	60	150	100	10	110
110	20	130	110	60	170				90	60	150	50	60	110

* Maximum field.

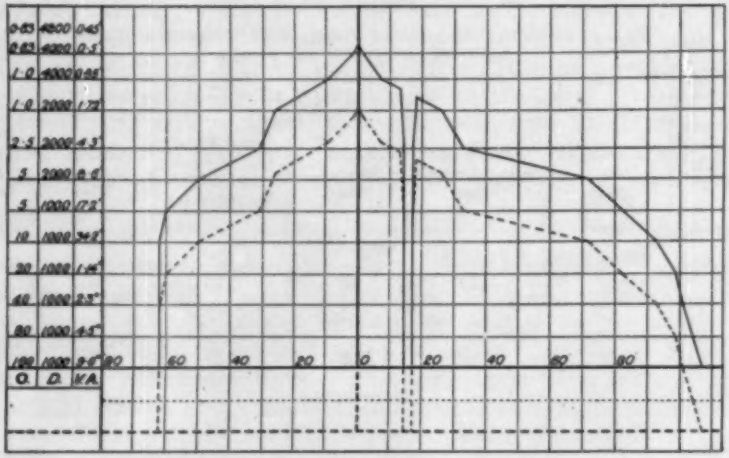

Fig. 1 (Danielson). *Horizontal section of field of vision.*

The familiar isopter diagram from Traquair's textbook showing particularly the "hill" of increased visual acuity in the central area. O is the diameter of the test object in millimeters, D its distance from the eye in millimeters, and V.A. the visual angle subtended at the nodal point.

clear vision of the peripheral field.

deRoetth speaks of practical fields of fixation, meaning the excursion of the eyes plus the turning of the head and body. It would seem only logical, therefore, to go a step further to coin the term *practical* fields of vision to mean the normal, static field increased by the movement of the eyes and

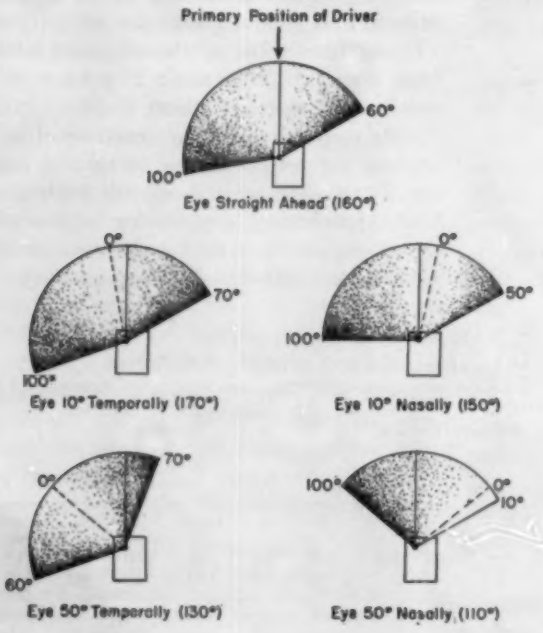

Fig. 2 (Danielson). *Variation in field with changing gaze* (to illustrate table 2).

To show variation in total horizontal uniocular field of vision of driver in various positions of gaze. (The shading shows the decreased vision in the periphery.) The measurements given are from the line of gaze (0°), when the eyes are turned from their primary position.

TABLE 3

LOCATION OF PRACTICAL PERIPHERAL FIELDS OF VISION OF LEFT EYE IN VARIOUS POSITIONS TEMPORALLY

Static and Normal Field Temporally	Static and Maximum Field Nasally	Position of Eyes, Head, and Body	Total Turn	Sees to Left (temp.)	Position of Nasal Limit of Field
100	60	All straight ahead on road	None	100	60° to right of straight ahead
100	70*	Turn eyes 50° temporally	50	110†	20° to right of straight ahead
100	70*	Turn head 20° temporally	70	130	Straight ahead
100	70*	Turn head 60° temporally	110	170	40° to left of straight ahead
100	70*	Turn body 40° temporally	150	210‡	80° to left of straight ahead

* On the nasal side the maximum field is 10 degrees greater than the normal field, that is, 70 degrees (Traquair).
† Limited by orbital margin.
‡ Thirty degrees over to right, that is, beyond straight back of driver.

head, as well as of the body.

In concentrating on how our peripheral field is increased in the direction the eyes, head, and body are moved, we should not lose sight of what happens to the other edge of the field, particularly in one-eyed drivers. Thus, by referring to Tables 3 and 4 and Figure 3, we see that when the one-eyed

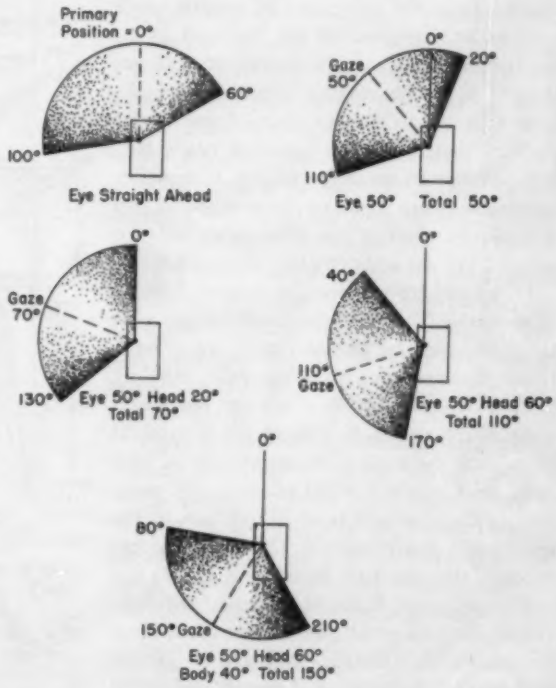

Fig. 3 (Danielson). *Practical fields of vision* (to illustrate table 3).

Measurements in degrees of limits of practical fields of vision of one eye (left for example) in various positions temporally to show primarily what happens to the nasal edge of the visual field—with reference to the primary position of the driver.

(left) driver is in the primary position in the car, he sees 100 degrees to the left and 60 degrees to the right. However, if the eye is turned 50 degrees temporally, the nasal border of the field is only 20 degrees to the right of straight ahead. If, in addition, there is a 60-degree turn of the head and a 40-degree turn of the body (as in changing lanes), the nasal (right) border will be 80 degrees to the left of straight ahead. In turning an eye nasally, one gets a similar interesting situation, but to a lesser degree.

By referring to Tables 1, 2, and 3, one can calculate the practical binocular field of vision by adding the practical temporal fields of the two eyes. In a normal individual, therefore, it is 420 degrees (210 degrees plus 210 degrees) which means that it is more than a complete circle.

The efficiency of the practical field is, of course, enhanced by the use of mirrors, which might be discussed in much detail. Suffice it to say that the ideal position for a mirror, from the viewpoint of moving one's eyes as little as possible off the road, is on the fenders, but from the viewpoint of largeness of field, the mirrors should be as close as practicable to the eye. One of the special mirrors that have been invented has a battery of five mirrors at five angles. It stretches across the entire width of the windshield and with it, by moving the eyes only, one can watch a person walk entirely around his car.

If we subtract from the practical fields of vision of the driver the limitations to visibility imposed by the car itself we get the resultant view from an automobile, the "car field." This car field is a narrow horizontal strip which varies largely in the horizontal plane with the motility of the eyes, head, and body, and in the vertical plane by the position of the driver's head in relation to the windshield and windows. This has been excellently discussed by Heath and Finch.

The practical fields of vision of an individual are to a great extent dependent upon the alertness, attitude, and ability of the driver. The environmental factors are out of the driver's control.

Graphs and tables in relation to personal road experiments

In order to reveal some objective evidence on the question as to the advisable field width for safe driving, I have devised some self-explanatory reference tables (tables 1-7) and figures (figs. 4, 5) which it is hoped will give some interesting facts to consider. The possible situations and combinations are in-

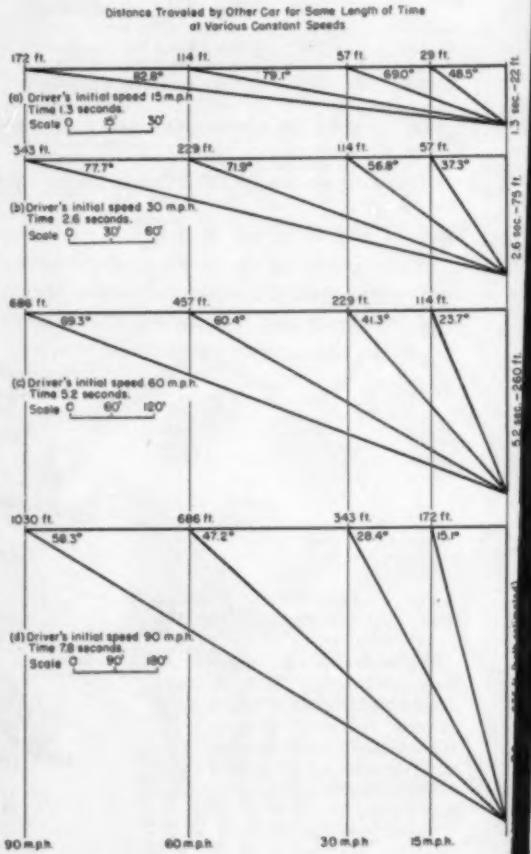

Fig. 4 (Danielson). *Fields of vision and stopping time.*

To show degrees of field of vision to left (or right) necessary for driver to see other car at driver's minimum stopping (reaction and braking) time assuming a reaction time of 0.75 seconds (reaction time at constant speed, braking time at decelerated speed). (Adapted from Evans, Henry K., and from material suggested by Vermont Highway Department.)

TABLE 4

LOCATION OF PRACTICAL PERIPHERAL FIELDS OF VISION OF LEFT EYE IN VARIOUS POSITIONS NASALLY

Static and Normal* Field Nasally	Static and Maximum Field Temporally	Position of Eyes, Head, and Body	Total Turn	Sees to Right (nasally)	Position of Temporal Limit of Field
60	100+	All straight ahead on road	None	60	100° to left of straight ahead
60	100+	Turn eyes nasally 50°	50	60†	50° to left of straight ahead
60	100+	Turn head nasally 50°	100	100	Straight ahead
60	100+	Turn head nasally 60°	110	120	10° to right of straight ahead
60	100+	Turn body to right 40°	150	160	50° to right of straight ahead

* On the temporal side the normal or relative field is practically same as the maximum or absolute field (Traquair).

† Limited by orbital margin.

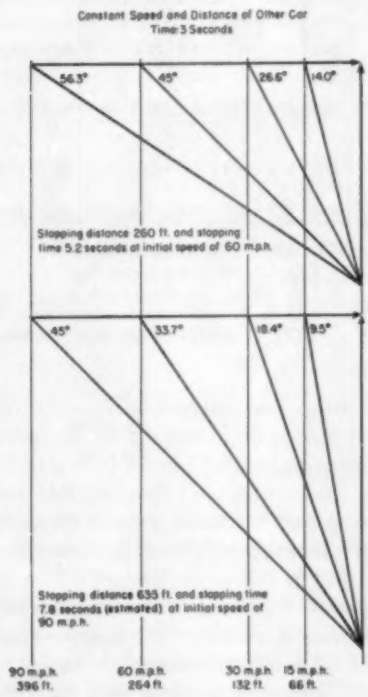

Fig. 5 (Danielson). *Angular relation of cars before collision.*

To show the angular position of the other car going at various constant speeds for cars that will collide at the intersection after (for example) three seconds—both going at constant speed, that is, neither making any attempt to stop. (Stopping distance and stopping time for the driver are given by comparison.)

finite and perhaps the tables and figures may act as a guide for more complete study.

In an endeavor to get some personal idea of the effect of deficiencies in the visual field, I drove many miles, first on the open road and then in the traffic of the city under varying circumstances. First, I tried out the effect of cutting my own fields with Bel-O-Cluders. One pair gave a uniocular and binocular field of 100 degrees (they are the same if under 160 degrees (table 2), and the other pair a 40-degree field (20 degrees either way). I had no sense of danger with either pair even at intersections; in fact, I had a sense of comfort by the blocking out of the blurred vision produced by speed (fig. 9), particularly on the road over the hood. One can get the same sense of relief by blocking out the area over the hood with one's hand or a cardboard.

There was, however, a definite sense of deficiency in trying to look back on either side while changing from one traffic lane to another. This deficiency was overcome by viewing the right and left side mirrors and an inside-the-car multifaceted mirror, thus obviating the necessity of turning the head and

TABLE 5

DEGREES OF ANGLE FROM DRIVER TO OBJECT

Feet beyond left side of road									Road					Feet beyond right side of road									
Feet beyond driver	5000 + 16.5	1000 + 16.5	500 + 16.5	100 + 16.5	50 + 16.5	25 + 16.5	10 + 16.5	5 + 16.5	(c) 16.5	(b) 7.5	(a) 4.5	Path of car	(d) 7.5	5 + 7.5	10 + 7.5	25 + 7.5	50 + 7.5	100 + 7.5	500 + 7.5	1000 + 7.5	5000 + 7.5	Feet beyond driver
5000 + 8	45.1	11.5	5.9	1.4	0.8	0.5	0.3	0.2	0.2	0.1	0.0		0.1	0.1	0.2	0.4	0.7	1.2	5.8	11.4	45.0	5000 + 8
1000 + 8	78.6	45.2	27.1	6.6	3.8	2.4	1.5	1.2	0.9	0.4	0.3		0.4	0.7	1.0	1.8	3.3	6.1	26.7	45.0	78.6	1000 + 8
500 + 8	84.2	63.4	45.5	12.9	7.5	4.7	3.0	2.4	1.9	0.8	0.5		0.8	1.4	2.0	3.7	6.5	11.9	45.0	63.2	84.2	500 + 8
100 + 8	88.8	83.9	78.2	47.2	31.6	21.0	13.8	11.3	8.7	4.0	2.4		4.0	6.6	9.2	16.7	28.0	44.9	78.0	83.9	88.8	100 + 8
50 + 8	89.3	86.7	83.6	63.5	48.9	35.6	24.6	20.3	15.9	7.4	4.4		7.4	12.2	16.8	29.3	44.8	61.7	83.5	86.7	89.3	50 + 8
25 + 8	89.6	88.1	86.3	74.2	63.6	51.5	38.8	33.1	26.6	13.0	7.8		13.0	20.7	28.0	44.6	60.1	72.9	86.3	88.1	89.6	25 + 8
10 + 8	89.8	89.0	88.0	81.2	74.9	66.6	55.8	50.1	42.5	23.0	14.0		23.0	34.8	44.2	61.0	72.6	80.5	88.0	89.0	89.8	10 + 8
5 + 8	89.9	89.3	88.5	83.6	78.9	72.6	63.9	58.8	51.8	30.0	19.0		30.0	43.9	53.4	68.2	77.3	83.1	88.5	89.3	89.9	5 + 8
0 + 8	89.9	89.5	89.1	86.1	83.1	79.1	73.2	69.6	64.1	43.0	29.0		43.0	57.4	65.4	76.2	82.1	85.7	89.1	89.5	89.9	0 + 8
0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	Driver	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	

Driver's eye is eight feet from front of car
Average road is 24 feet wide
Average car is six feet wide
Driver's eye is 1.5 feet from left side of car
Driver's eye is 4.5 feet from right side of car
Overlap in each lane side of car or center strip to car, three feet

The driver's (dominant) eye is:
(a) 4.5 feet from center line
(b) 7.5 feet from near side of oncoming car
(c) 16.5 feet from left side of road, and
(d) 7.5 feet from right side of road

body in changing lanes. It cannot be overemphasized that, in changing lanes or turning, safety can be greatly increased by signals, that is, letting the other driver know what you intend to do.

While driving with these occluders, I noted that both sides of the road, the center lane, and the oncoming traffic were all in the 30-degree range, even up to the view over the hood at 25 feet (table 5).

A further experiment was to drive with the central field occluded. I did this by placing adhesive or Scotch Tape on my glasses at the estimated 50 degrees of central field (25 degrees in each direction) leaving the periphery free and a central small hole about four degrees in diameter. While I was able to drive under the circumstances, I found quickly that I had a feeling of irritation, discomfort, and danger; this was in marked contrast to the lack of these symptoms when the peripheral field was blocked out.

I even did the questionably justified experiment of putting Scotch tape over the whole of each lens, which reduced the vision to 20/200, and blocked out the field to about 50 degrees each way. (This is about the field inside of the average spectacle rims.) I was able to discern the center stripe sufficiently well to stay in my lane and to meet other cars without mishap. The Scotch

TABLE 6

RELATIVE ANGLES OF CARS AT CONSTANT SPEED WHICH WILL COLLIDE AT THREE SECONDS

Speed Driver	Speed Other Car				Driver's Car Stopping D.	Driver's Car Stopping Time
	90 m.p.h. 396 feet	60 m.p.h. 264 feet	30 m.p.h. 132 feet	15 m.p.h. 66 feet		
15 m.p.h. 66 feet	80.5	76.0	63.4	45.0	22 feet	1.3 sec.
30 m.p.h. 132 feet	71.6	63.4	45.0	26.6	75 feet	2.6 sec.
60 m.p.h. 264 feet	56.3	45.0	26.6	14.0	260 feet	5.2 sec.
90 m.p.h. 396 feet	45.0	33.7	18.4	9.5	635 feet	7.8 sec.

tape had the experimental advantage of giving the partial but uneven blur that one conceivably gets with a retinopathy, without the complete obstruction one would get with adhesive tape.

Furthermore, I noted that when I fixed steadily at varying angles from straight ahead, the center lane and the sides of the road became indistinct and inadequate as a guide to driving when the gaze was off center more than 10 degrees to 15 degrees.

Tables 5 and 7 give an idea of the angles produces by objects, cars, and width of road. One can work out the angle, suggested by Traquair in discussing test objects. His formula is:

$$\frac{\text{Test object}}{\text{Distance}} \times \frac{180}{\pi} = \text{angle}$$

$\frac{180}{\pi}$ is a constant 57.3.

Thus, the length of a car (18 feet) at the usual length of a city block is $18/400 \times 57.3 = 2.6$ degrees; or at 100 feet the angle is 10.4 degrees; or, for example, the width (six feet) of a car at 58 feet gives an angle of 6.9 degrees, while the width of the 24 foot road at 58 feet ahead of a driver (table 5) is 23.7 degrees.

At 57.3 feet (the same as the constant 57.3) the width of the object in feet is almost the same as the degrees subtended up to about 25 degrees (tables 5 and 7). Interestingly, this distance of approximately three car lengths is of definite importance, particularly in the predominantly intersectional driving in a city.

The statement frequently appears in the literature that in driving one should keep one's eyes moving. It may be quibbling, but it would seem more important to recognize and stress the viewpoint that, when one remains alert in driving, the eyes will automatically keep moving. Alertness also affects the field, in that it is well known that one sees quicker in any direction if one is expecting something from that area.

I also checked the effect of moving the

TABLE 7

WIDTH AND LENGTH OF AVERAGE PASSENGER CAR

Distance	Width Car in Degrees	Length Car in Degrees
At 1,000 feet	0°04′	0°05′
At 500 feet	0°41′	2°04′
At 100 feet	3°26′	10°16′
At 50 feet	6°52′	20°25′
At 25 feet	13°42′	39°36′
At 10 feet	33°24′	84°00′
At 5 feet	61°55′	121°56′
At 1 foot	143°10′	167°15′

The height of average passenger car is about 5.5 feet. Width six feet. Length approximately 18 feet.

eyes off the road and back at various angles and rates. In looking about 20 degrees to the side I found that I could leisurely make about 16 excursions (32 movements) per minute. By consciously forcing myself to make more rapid oscillations, I could make as many as 60 excursions (120 movements) per minute, but only at the expense of dizziness and danger. Repeated turning of the eyes to the 50 degree limit could be done only half as fast, and with increasing discomfort and lack of safety. Although the findings here given are in excursions per minute, I found that tests longer than 30 seconds were fatiguing.

The glance to the side can be either rapid or slow, but if we estimate the time taken for an excursion to be one second, we will also have traveled during that time 120 feet at 90 m.p.h., 90 feet at 60 m.p.h., or 45 feet at 30 m.p.h. An easy rule to follow in figuring how far one travels in feet during a second is to take the speedometer reading and add half the reading to it. During this glance our macular fixation is off the road, but the road is usually in the field, depending on how far the eye turns (tables 3 and 4 and fig. 2). With the quick glance of small amplitude usually employed, the road remains in the central field. When the head and body are also both turned, the road is in the peripheral field or even out of it entirely.

There is need for a theoretical and experimental study by a mathematically-trained traffic expert to correlate the factors of speed, reaction time, braking distance, stopping distance and time, angle of object to the side, angle subtended by object, and the visual acuity of the central and peripheral fields. A token effort has been made in this paper in Figures 4 and 5.

My impression on this subject is that beyond 60 degrees the visual acuity is ordinarily so poor that we get little useful information. The familiar isopter concept has been stated in another way by Fletcher, who quotes Luckeish as saying "the visual acuity drops off 80 percent at a distance of 2.9 degrees from the fovea, 90 percent at 5.8 degrees, 95 percent at 12 degrees, and 99 percent at 30 degrees." When the object in the far peripheral field is close enough that it can be intelligently perceived and recognized, it is already too late to prevent a collision (fig. 4). This is particularly true at high speeds; in the lower speeds of city traffic, fortunately, the collision is less likely to be lethal. However, if the reader will merely try to drive across a busy street on peripheral vision alone, he will have it dramatically impressed on him, that, in order to be safe, one must get a view each way with the better vision of the central field.

Experiments such as these on one's self might well be made a separate study, but let me give a word of caution. While driving during these personal experiments as just described, and in studying the use of mirrors, I almost had an accident several times, not because I could not see, but because I was thinking of something besides driving. The attention of a driver should be on driving, and not actively on solving a problem. Accident experts will verify the fact that a very large percentage of accidents happens when a driver is angry or otherwise actively mentally engaged.

Factors that affect field of vision

Introduction

The many diseases and abnormalities which affect one's field of vision are to be found in the textbooks. Here we shall attempt only to discuss the conditions and situations which seem to have a reasonable relationship to safe driving.

The factors that affect the personal fields may be discussed under the broad headings of (1) diseases of the media, (2) diseases of the fundi, (3) diseases of the visual tracts, (4) the blindspot, (5) the loss of one eye, (6) effect of drugs, (7) errors of refraction, (8) fatigue, (9) training, and (10) abnormalities of movement.

CATARACT, APHAKIA, AND CORRECTED APHAKIA

The most important disease of the media is, of course, cataract. It has been my opinion for some time that in determining the indications for removal of a cataract too much emphasis has been placed on its effect on visual acuity. Perhaps much more attention should be given to the effect of cataract and subsequent aphakia on the visual fields. The reader need only to take a field on an eye with an immature cataract (vision down even to 20/100) and compare it with the field on the aphakic eye to see how little difference there is (figs. 6 and 7).

In order to get some additional information as to how cataracts, aphakia, and subsequently corrected aphakia affect an automobile driver, and particularly his fields, I sent out a questionnaire to a list of 232 consecutive cataract extraction patients in our office. Although there must be many factors and situations difficult to assay without careful analysis, these are the main findings on the basis of the replies received.

Of 130 queries returned, 72 persons polled said that they had driven a car before surgery, and 58 that they had not. Seventeen of the 72 had quit driving after surgery but only one said it was due to poor field of vision. The others no longer drove for various other causes. Of the 72, six complained of increased difficulty in backing up and 18 had no complaints. Forty-nine said they had no trouble gauging distance from other cars; 18 did have trouble; and five volunteered that cars seemed closer than they were. To the question as to whether they had trouble seeing on the side of the operated eye, 25 said "yes" and 30 said "no." Comments indicated that many were bothered, however, more by difficulty in seeing to the side than in gauging distance. Four replied that they had trouble changing lanes and 48 had none. Not one person had had an accident since the surgery, admittedly, a short time, however. The logical conclusions then would seem to be that the admittedly defective peripheral vision in corrected aphakia does not deter most people from driving, and that the central field is adequate for safe driving.

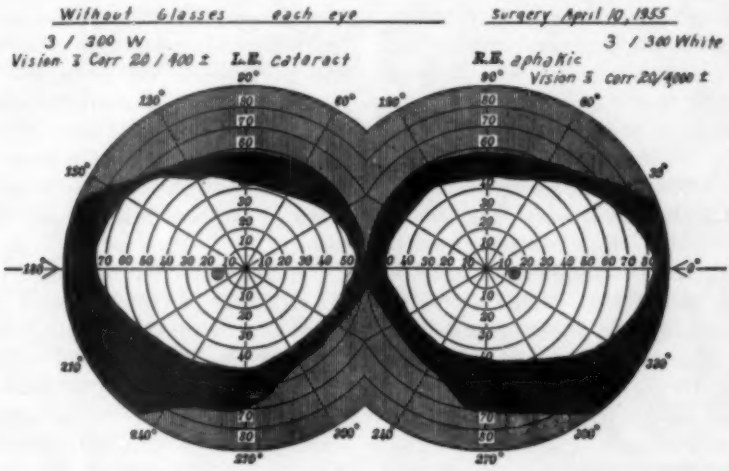

Fig. 6 (Danielson). *Comparative fields when vision uncorrected.*
To show comparative fields of one eye with cataract and the other aphakic—both uncorrected.

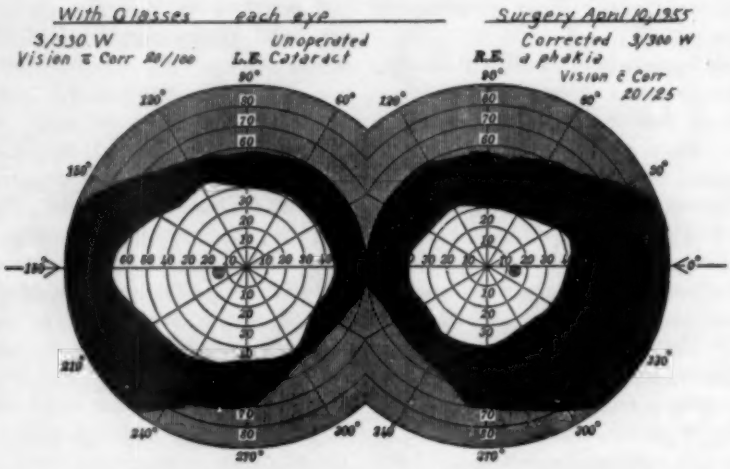

Fig. 7 (Danielson). *Comparative fields when vision corrected.*
To show comparative fields of one eye with cataract and the other eye aphakic—both corrected.

FUNDI

In discussing diseases of the fundi, I would stress the importance of the quality of the central field in contrast to that of the peripheral field. Most of the diseases encountered, such as retinopathy of diabetes and arteriosclerosis, senile and vascular degenerations, and early glaucoma, affect that area predominantly. In glaucoma, of course, we also get marked peripheral contractions.

As for retinal detachment, it is the postoperative field that is important. The acute cases seek aid and quit driving. Interestingly, we have a 45-year-old patient who has undergone bilateral operations for cataract and repeated bilateral operations for retinal detachment. He now has complete reattachments with corrected aphakic vision of 20/40 in one eye and 20/200 in the other. His fields are limited to 25 degrees or less in all meridians bilaterally. He has done a large amount of driving for a year without an accident and assures me that he drives without much difficulty.

We have under our care a 60-year-old deaf mute with only one eye, who had cataract surgery in 1948 and a retinal detachment operation in 1951, with corrected vision of 20/25, and a moderately reduced field. He has driven a car without accident or traffic violation ticket, notwithstanding his 10 years of visual difficulty.

VISUAL TRACTS

The field changes in injuries and vascular accidents are usually so sudden, and other accompanying disabling factors so marked, that individuals with such disabilities stop driving. However, in intracranial tumors, particularly of the pituitary, the changes are so slow that the patient adjusts to the new situation. Oleson reports 16 cases of pituitary adenoma with marked field changes, five of whom had been driving cars, all without mishap.

I am herewith reporting a case, personally observed (fig. 8), of a 55-year-old pharmacist who had driven 200 miles over mountain roads at the usual road speeds to get a pair of glasses so that he could read the price tags better. On examination, he was found to have a corrected vision of 20/50 in each eye, normal fundi, an almost complete bitemporal hemianopsia with marked contractions in other meridians. He said he had been driving at the same speed as other

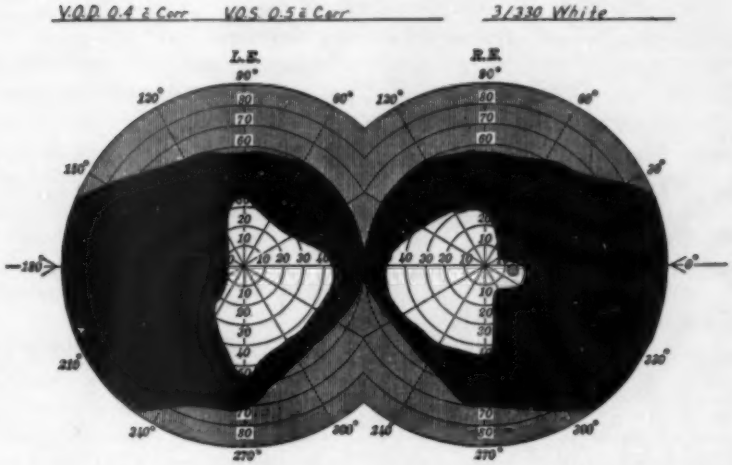

Fig. 8 (Danielson). *Field of driver with bitemporal hemianopsia.*
Fields of man with pituitary adenoma who had driven many thousands of miles without accident.

drivers with no difficulty other than that he had had to turn his head to the side a little farther than formerly in order to see at intersections.

Here we have the unusual case of a driver who had slowly become accustomed to seeing the left side of the road with the right eye and the right side of the road with the left eye. He had no accidents. Dr. Max Kaplan, a colleague, tells me he has had a similar case. Since becoming interested in this subject, we have been amazed at the number of people with markedly defective visual acuity and fields of vision who insist that they are driving without much difficulty.

Blindspot

The blindspot has been mentioned frequently as a possible cause of accidents. That it does not result in more trouble seems, offhand, to be peculiar, but is to be accounted for by (1) the field of the other eye, (2) movements of the car, objects in the field, and of the eyes, head, and body (Darcus), and (3) by the phenomenon of completion, as discussed by Duke-Elder and Bender. Berens stresses the importance in one-eyed drivers. I have prepared Tables 8 and 9 to illustrate the relation of the blindspot to the driver's field and to the road. Traquair's formula, previously mentioned, can be used to figure any particular distance.

While doing the personal road tests described earlier, I noted that when my car was not in motion, I could easily get an obstruction into the blindspot, but as soon as the car was in motion, I could not do it.

Hutchinson, King, Fletcher, and others speak of "tunnel vision," but, for the record, we should call attention to the fact that tubular or tunnel vision is a result of a functional disorder such as hysteria or malingering, whereas organic disorders produce cone-shaped fields, which, when narrow, have erroneously been called tunnel vision (Duke-Elder). The significance of the increase in field with distance is illustrated by the following case report.

Case report

One of the most illuminating cases that we have encountered is in a 65-year-old woman who has had peripheral pigmentary degeneration of the retina since childhood. Her corrected vision is 20/25 in the right eye and 20/20 in the left. The 3/330 mm. white field of each eye (and, therefore, the binocular field also!) is not over 20 degrees total. Yet this woman claims that she has had no acci-

TABLE 8

HEIGHT AND WIDTH OF BLINDSPOT

Distance from Eye	Height (7.5°)	Width (5.5°)	Relation to Size of Cars
(feet) 5,000	(feet) 656.00	(feet) 480.00	Width of car—6 feet Height of car—5.5 feet Length of car—18 feet
1,000	131.20	96.00	
500	65.60	48.00	
200	26.24	19.20	Approx. length of car
100	13.12	9.60	
50	6.56	4.80	Approx. width and height of car
25	3.28	2.40	
10	1.31	0.96	
5	0.66	0.48	
1	0.13	0.10	

dents in 40 years of daylight driving in familiar territory.

Her complaints, oddly enough, are not related to driving, but to activities close to her. She says she has more difficulty as a pedestrian than as a driver, not only in avoiding objects, but in walking with people without straying away from them. Her main trouble is in doing her own housework and in cooking; she is continually breaking dishes while putting them away in a cupboard.

This can be explained, because a 20-degree field at one foot is 0.35 of a foot (about four inches); at three feet, it is about one foot; at 10 feet, it is 3.5 feet; at 100 feet, it is 35 feet; and at 1,000 feet, 353 feet. At 50 feet, it is the length of a car, and when combined with a 50-degree turn of the eyes, 60-degree turn of the head, and 50-degree turn of the body, we have 170 degrees as the limit on either side that can be seen. Of course, her deficiency of field is thus very large and includes all of the road and both sides of the road except for the small cone of field.

LOSS OF ONE EYE

Entire loss of visual field of one eye, either

TABLE 9

DISTANCE OF CENTER OF BLINDSPOT TO SIDE OF FIXATION

Distance from Eye	To Side of Fixation	Relation Road to Driver
(feet) 5,000	(*15.5 degrees*) (feet) 1386.50	
1,000	277.30	(Center of blindspot is 1.5° below fixation and 152.7 feet from driver.)
500	138.65	Center blind spot strikes road level
100	27.73	
50	13.86	Left side of road when driver in center his lane (76.5 feet)
25	6.93	Right side of road when driver in center his lane (7.5 feet)
10	2.78	
5	1.39	
1	0.28	

by disease or enucleation, is important because of its frequency. Much has been written about the one-eyed driver by Holmes, Berens, Weekers, Manes, Schwarz, Kerr, and De Silva.

The effect on the driver of losing an eye depends on the suddenness of the loss. Weymann, Schwarz, and Berens have suggested a mandatory period of adjustment after enucleation of a previously good eye before a person should be permitted to drive again.

In order to get the personal reaction of a group of people who had lost one eye, we sent a questionnaire to 225 individuals who had had an eye removed. The answers are tabulated in Table 10. A very intelligent man for whom I removed an eye eight years ago insists that, because he now takes more precautions and pays more attention to his driving, he is a much safer driver than when he had two eyes.

One might assume that a one-eyed driver could increase his nasal field by looking temporally, but such is not the case. Let the reader try it for himself (Fletcher, Duke-Elder). For instance (tables 1, 2, and 3 and figs. 2 and 3), if the driver with a remaining left eye turns his eye 50 degrees to the left, he has only 10 degrees of field on the nasal (right) side of straight ahead on the road, and if he also turns his head and body to the left, the nasal side of his field will be entirely off the road to the left, leaving all of the road entirely out of his field.

TABLE 10

ANSWERS TO A QUESTIONNAIRE SENT TO INDIVIDUALS WITH ONE EYE

1. Questionnaire sent out	225	
2. Questionnaires returned	81	
3. Number who quit driving because of smaller field	None	
4. Trouble in gauging distance from other cars	Yes 10	No 36
5. Any difficulty seeing cars on side eye removed	Yes 20	No 21
6. Any difficulty seeing cars on side eye not removed	Yes 3	No 33
7. Any difficulty in changing lanes easily and safely	Yes 6	No 41

DRUGS AND TOXIC AGENTS

Drugs have not been considered to have much effect on the fields of vision. There is no reason to believe that the drugs (for example, methanphetamine, Dexedrine, Benzedrine), so commonly used to keep awake, have any effect on the fields except indirectly, through alertness.

As for toxic agents, alcohol would be the most common. Its effect on judgment is well known. The traditional diplopia and confusion involve the fields as well as the point of fixation (Brecker, Hartman, and Leonard).

ERRORS OF REFRACTION

The effect of errors of refraction upon visual acuity is obvious, but the effect on the fields of vision, particularly the central fields, has been given entirely too little attention, both in the testing of the field and in its relationship to driving ability. If the reader with considerable error of refraction will observe its effects the next time he is driving without his glasses, he will notice that the lack of clearness which bothers him is not so much related to the point of fixation as to the central fields.

TRAINING AND ATTENTION

There has been some discussion by Brody, Sherman, Lauer, and Low to the effect that fields can be improved by training.

FATIGUE

We are all familiar with the fatigue field illustrations of Traquair and Peter. It would seem logical that fatigue could affect the fields of a driver (Brody). It would also seem possible that the poor vision in the central fields could produce and increase fatigue (Lauer).

ABNORMALITIES OF MOVEMENT

By referring to Tables 1, 2, 3, and 4, one can see that abnormalities of movement of the eyes affect the binocular fields to some extent. In convergent strabismus of 60 de-

grees, the binocular field is almost the same as the monocular field of the fixing eye. In divergent strabismus, the fields cannot be increased by more than 20 degrees (10 degrees each eye limit of increase by looking temporally). Peculiarly, in most cases of paralytic strabismus, the normal binocular field is approximately the same whether looking in the field of the paralyzed muscle or not.

Environment, including speed

The factors in the environment which limit the view and which are of possible danger are probably more important than the person's own fields.

Outside of the car there are: (1) General obstructions, such as dust, fog, rain, and snow; and (2) local obstructions, such as other cars, trees, shrubs, buildings, signs, and curves in the road, as discussed by Smeed and Lebensohn.

Inside the car we have: (1) Poor visibility through windshields and windows due to dirt and stickers; (2) obstructions to the view by objects in the car; and (3) obstructions even on the person, such as large hats and heavy frames to spectacles and heavily tinted lenses.

Allied to outside obstructions are the variations in amount and position of lighting, such as darkness, too much light, glare, and "visual noise," such as moving electric signs. Electric signs with rapidly moving designs, particularly of the on and off type, when in the central field are not only distracting (that is their function), but may be otherwise dangerous, because of the phenomena of extinction as described by Duke-Elder and by Bender. They should be prohibited near the view of traffic lights. An electric sign or light in the central field should never be brighter or more attractive than the traffic light itself. We have all experienced the extreme fatigue resulting from facing glaring lights in the field. In fact, some mathematical formula should be devised by an illumination engineer which would take into account the intensity of the light and the nearness of that light to the area of macular fixation. The lowered accident rate with increased general lighting, however, has been stressed by Fletcher, Luckeish and Roper, and Lebensohn.

Another factor modifying particularly the peripheral field is the effect of speed. The faster the speed, the narrower the clear zone (fig. 9). This "speed smear" (my term) does not bother us until we approach the central zone and accounts for the fact that, as we go faster, we look progressively farther ahead of the car (Hockenbreamer). Byrnes believes part of the discomfort is due to the rapid changes in size of objects. It is unfortunate that this speed smear does not impart to the driver more of a sense of danger, such as one gets while standing by the side of the road when a car speeds by. In fact, there is need of finding methods of giving a sense of fear to a driver.

The view over the hood of the average car allows us to see the ground about 25 feet ahead, whereas a bus driver can see as close as six feet. Thus, a bus driver has more need for good inferior fields than does a passenger car driver, and he is bothered more by the speed smear.

Road signs are recognized not only by the captions thereon, but also by their shape. The shape of objects is effectively seen only in the narrow macular and perimacular zone of the total field. In view of high speeds, road signs should be sufficiently large and of the proper shape to be recognized promptly at long distances.

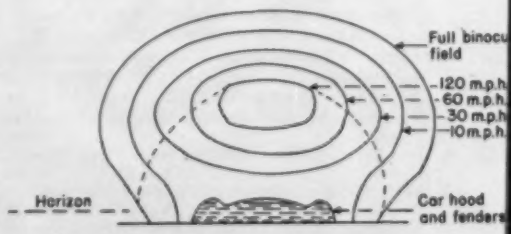

Fig. 9 (Danielson). *"Speed smear."*
To illustrate narrowing zone of clear field due to increasing speed.

Apparatus and methods now in use

Some of the many types of apparatus and methods for doing field of vision screening that have been used and proposed by others are:

1. The familiar confrontation test as described in many textbooks (Duane and Hughes) has been used satisfactorily by Leinfelder and many others for rough field testing for driver's licensing. It should be recognized, however, that, as described as a comparison with the examiner's fields, it will measure out temporally to only about 70 degrees (and similarly restricted in other fields). To get a measure of the person's full field by finger movements or test object, one must bring the test object from behind his head, in which case the 90-degree field for the examinee will be about 60 degrees for the examiner. The movement of the fingers should be stressed, for motion field is larger than the mass or form field, as described by Brombach.

2. The American Optical Company Sight-Screener has a field of vision attachment that will measure from 100 degrees to 60 degrees temporally.

3. The Bausch and Lomb Orthorater has an auxiliary attachment which permits measurement down to fixation.

4. The periometer of the Keystone View Company Telebinocular also measures down to fixation.

5. The American Automobile Association has a table screener on legs, and a driver evaluator with a field attachment. This measures down only to 65 degrees and only on the temporal side.

6. Homemade types of plywood boards cut to fit the nose with angles marked at the periphery have been recommended by Reid, Lauer and Kotvis, and Nuchols and Lauer, with the angles subtended marked at the edge of the board.

7. Fletcher says the office type perimeter and the Schweigger hand perimeter have been used.

8. Harrington and Flocks have devised a screener that utilizes tachistoscopic illumination by an ultraviolet light of patterns made with luminescent ink. It departs radically from other field of vision screening machines in that it measures the central fields instead of the peripheral fields. It is the belief of the inventors that most lesions of the periphery will show centrally as well.

Report on cases studied and apparatus used

Although the screening method of Harrington-Flocks has been utilized to advantage in many ways, no report is available on its use as part of a driver's test. I, therefore, decided to test a group by this method and at the same time try out some of the other screening devices for a partial comparison. Inasmuch as all the emphasis on driver's fields up to date has been on "how far you see to the side," the method, which measures central fields to 25 degrees, seems offhand not to have much value as a test. Nevertheless, ophthalmologists have known for a long time that in diagnosis the field changes in the central area are just as valuable as those in the periphery, and perhaps more so, and one wonders whether the emphasis should be rather on "how well you see in the central area."

This testing at the driver's bureau was done on volunteers by an examiner who knew little about eyes. This immediately brings up the research defect of inadequate controls and follow-up. Yet, there was some advantage in doing the test in this manner, which simulates more nearly the conditions under which the tests would be made if the the method were adopted for screening. However, to anyone who might be interested in going into field screening research in more detail, I would suggest that it be done at a private or public clinic over a period of years on thousands of cases, where diagnoses, and repeated and multiple tests, are available. One could then compare these findings later with the driver's records of safety in the Motor Vehicle Office of the area.

The work was done in the summer vacation by a first year medical student. It was impossible for him to examine all the drivers. The regular examiners were therefore instructed to refer the following cases, which, of course, overlap:

1. Visual acuity on the borderline of, or below, passing.
2. Age over 65 years—about 100 cases.
3. Strabismus—about 10 cases.
4. One-eyed drivers, that is, eye lost or blind—18 cases.
5. Those considered otherwise interesting —about 20 cases.
6. Drivers over 50 years of age, when above classes not available—about 400.

Although the total number of volunteers examined (680) seems rather large, it was early realized that from the accident viewpoint (in view of many factors involved) any correlation would be statistically valueless. Patients were asked about their accident records (replies to such questions are notoriously unreliable), but no investigation was made. Suffice it to say that no cases were encountered in which a defective field of vision was believed to have caused an accident.

Due to the fact that alterations were being made in the building during the testing, it was necessary to use two different rooms. Most of the work was done in a separate small room where the light, during the testing, varied from about two to seven foot candles, depending on the time of day and number of lights turned on. The large room was the main examining room where there were present 25 to 100 applicants and employees at all times. Ninety-three were examined in the large room and 587 in the small room.

Results of the tests are summarized in Tables 11, 12, and 13. Of the 680 applicants tested, Table 12 shows that there were 117 who had vision of 20/40 or less in the poorer eye. With the Harrington-Flocks method, 53 missed all patterns, 27 missed some or part of a pattern, and 37 missed no patterns. Of the 27 missing some patterns or test objects in the patterns, seven had visual acuity of 20/70 or less; eight had 20/40 or better; and for the remainder there is no record.

For added information 35 of the drivers who had missed all of the patterns and the 27 who had missed some of the patterns or test objects were asked by letter to volunteer again for more testing, this time at the Medi-

TABLE 11

GENERAL TABULATION OF FIELD OF VISION TESTS

1. Total people tested (in categories listed in introduction)	680
2. Number referred because vision 20/40 or below	117
3. The remainder in other categories (see explanation)	563
4. Tested by the Harrington-Flocks method	680
5. Peripheral fields tested by Keystone Perimeter also	340
6. Peripheral fields tested by Amer. Auto. Assoc. Screener also	340
7. Peripheral fields tested by Amer. Optical Co. Screener also	20
8. Peripheral fields tested by finger movements also	350

TABLE 12

COMPARISON OF THE CENTRAL FIELD TESTS BY MULTIPLE PATTERN METHOD WITH THE PERIPHERAL TESTS BY OTHER METHODS

1. Number seen with vision 20/40 or poorer (most around 20/100 or less). (This includes those of other categories, but who also had poor vision	117
2. Number who missed all stimuli of all patterns of Harrington-Flocks apparatus	53
a—Blind in one eye	18
b—Remainder	35
a^1—Peripheral (temporal) contraction to 80° or less	4
a^2—Peripheral (temporal) contraction to 60° or less	3
b^1—Normal peripheral field	31
3. Number who missed some patterns or some stimuli on a pattern	27
a^1—Temporal contraction to 80° or less	12
a^2—Temporal contraction to 60° or less	4
b^1—Reading above 80°	15
4. Number with no patterns or stimuli missed	37
a^1—Temporal contraction to 80° or less	8
a^2—Temporal contraction to 60° or less	4
5. Summary—other than blind eye	
a—Total and partial failure to multiple pattern method (35+27)	62
b—Temporal contractions to 80° or less	24
c—Temporal contractions to 60° or less (of the 24)	11
d—Ability to see finger movements only	4
e—Inability to see any targets anywhere	2

TABLE 13

PERIPHERAL (TEMPORAL) READINGS BY VARIOUS METHODS

I. Number tested by Keystone Periometer	340
1. Number tested in small room (see explanation)	247
a—Total measurement more than 80°	213
b—Temporal measurement 80° or less	34
a^1—Temporal measurement 80° or less (9 blind not included)	25
b^1—Temporal measurement 60° or less (9 blind not included)	2
2. Number tested in large room	93
a—Temporal measurement more than 80°	7
b—Temporal measurement 80° or less	86
a^1—Temporal measurement 60° or less	2
3. Total both rooms (93–34)	127
a—Loss to 80° or less (blind not included) (25–86)	111
a^1—Loss to 60° or less (blind not included)	4
II. Tested by American Automobile Association apparatus (all in small room)	340
a—Temporal measurement more than 80°	321
b—Temporal measurement 80° or less (including 9 blind)	28
b^1—Temporal measurement 60° or less	None

cal School Clinic. Only five of the 35 appeared. Three could still see no patterns; two could see some; one, only if larger test objects in the patterns (designed by us) were used. All cases had vision below 20/40; four had an organic pathologic alteration; the fifth had severe amblyopia with esotropia and he volunteered that he thought he missed them all at the first test because he had taken a "glare" test just previously. The peripheral field of all was better than 60 degrees temporally.

Of the 27 who had partial loss of patterns, 10 reported for re-examination. Interestingly, all 10 of them were able to see all the targets, but two of them only when the larger targets designed by us were used. Unfortunately, peripheral fields were not repeated. Pathologic changes were found in half of these cases and, therefore, it would seem fairer to say that in some defective eyes the test will vary according to conditions, rather than to call the results false positives. Perhaps the phenomenon of extinction enters into this situation. In these cases I believe the better reading on the subsequent examination was due to the fact that the second tests were done in lower illumination and in a more uniform peripheral background.

Twenty-two of the 680 subjects were so-called "re-examinations" because they had had several accidents or traffic violations. Only one had a Harrington-Flocks defect. Three had peripheral contraction on the Keystone to 70 degrees. Of the 11 who had had intersection accidents, none showed a defect by any method.

Of the 340 subjects tested by the Keystone apparatus, 127 showed a peripheral field reading of 80 degrees or less. One hundred eleven of these had a normal reading by the Harrington-Flocks method; 16 (including nine blind) had an abnormal reading. This high figure of 127 seemed odd, until the technician called my attention to the singular fact that of those 127, 93 had been tested in the large room and only 34 in the small, more ideal, room. Of the 93, only seven were above 80 degrees.

These facts point out the need for an ideal environment for taking fields, even screening tests. In the large room there were in the environment (1) variable lighting in the field, (2) points of glare from several overhead strong lights, (3) objects of variable contours, (4) examiner and people, many with white shirts, moving about, and (5) an audience of many people watching the test. It should be recognized that the proper environment and background, and co-operation and attention of the patient, are much more necessary for a correct field determination than for merely taking visual acuity. It should be mentioned that even the Harrington-Flocks apparatus worked better in both rooms when shielded.

Of the 340 tested by the A.A.A. machine, there were 28 with some defect to 80 degrees or less; of these, nine were totally blind. Of the remaining 19, eight read 80 degrees and 11 read 75 degrees, and none less that that. This smaller number of defects recorded by

the A.A.A. machine than by the Keystone apparatus is to be accounted for by the facts that:

1. All A.A.A. tests were done in the small room

2. There are two shielded lights in the apparatus for illumination.

3. There is a flange to block out the background.

4. On some models the test object, on which there is a cross, turns and gives more of a sensation of motion.

5. The test objects, although of the same width, are closer to the eye, thus increasing their relative size. The round test object of the Keystone—one-half inch at 18 inches—subtends an angle of 0.8 degrees. The oblong test object at eight inches on the A.A.A. is 0.5 by 1.0 inch and subtends angles of 1.8 degrees and 3.6 degrees respectively. At my suggestion, the local examiners have built the flange on the A.A.A. machine two inches higher to obliterate the environment even more and give a better background.

Captain Dahlstrom, of Denver, who has supervised the examination of 7,000 drivers for the Police Department and 2,000 for a truck rental company, using the A.A.A. apparatus, makes the astounding and almost incredible statement that, if the cases with a blind eye were ignored, only one case had been found where the temporal reading was under 60 degrees. He estimates that over 95 percent of those tested had a reading of 90 degrees or more.

Furthermore, the Driver's Bureau and the American Automobile Association representative report that, from a study of thousands of cases in their high school education program, it is very rare to find a student with a significant field defect.

The size of the test object for screening should be larger than that used for clinical testing. In an office a patient does not cheat, for he comes for diagnosis and relief of symptoms and the finer the test, the better. The finer the test, the greater the chance of false readings, but the ophthalmologist is aware of the chance of false answers and proceeds accordingly. In a screening procedure, however, the aim, for the sake of public relations, should be to be as sure as possible that cases are not incorrectly referred. We are all aware of the indignant parent whose child has been referred to an oculist's office by a too strict visual screening program.

Therefore, the following measures should be taken to avoid unnecessary referrals and rejection of licenses: (1) a trained examiner who has been taught the pitfalls; (2) a special and separate room for proper environment and background; (3) proper illumination for the test being used; (4) larger test objects; and (5) opportunity for checking findings two or three times, as recommended by the A.M.A. committee.

Our experience with field determinations by finger movements, done on 350 candidates (see previous discussion), is that the results are about the same as with the Keystone (properly used) or the A.A.A. The moving finger technique cannot be suitably recorded, but has the advantage of handiness and motion, and, in my opinion, is entirely adequate for finding gross defects. Many excellent neurologists use it for even finer localizing work in diagnosis. We have found that the examinee can see the fingers easier and quicker if white thimbles are placed on the fingers. Most civilian airplane pilots are tested for field of vision by the finger movement test only.

The advantages of the A.A.A. apparatus are: (1) It is handy to adjust the face; (2) it is easy to explain; (3) the fixation is better because it is binocular; (4) the cross on the target turns; (5) there is uniform background for contrast. The disadvantage is that it measures only down to 60 degrees, and there is no nasal reading.

The advantages of the Keystone telebinocular with periometer and the Bausch and Lomb attachment are: (1) It is part of an apparatus already used in many places for testing visual functions particularly

visual acuity; (2) it measures all angles from 90 to zero degrees. The disadvantages are: (1) The subjects do not fix as well as on the A.A.A. apparatus; (2) the targets do not have "oscillation"; (3) it is not easy to read the dial and watch the patient's eye for fixation; (4) there is no uniform background; (5) the forehead rest is apt not to be in the center of the forehead.

The Harrington-Flocks test has the following advantages: (1) It tests the extrafoveal area most used in high speed driving; (2) the test is more independent of environment and background than most of the peripheral field techniques; (3) it is more apt to pick up defects in the field that point to concomitant diseases which, of themselves, make the patient more dangerous on the road; (4) it is the only machine that tests in other than the horizontal field.

The disadvantages of the method are: (1) There is possibly a greater chance of getting false positives or variations at different examinations; (2) fixation of the patient's eye cannot be watched well, particularly when testing the right eye; (3) examiners and applicants are more impressed with the peripheral field tests; (4) it is not wholly satisfactory in aphakia or high errors of refraction; (5) an additional machine is necessary; (6) the answers obtained in testing elderly people are frequently unreliable.

Twenty persons were tested by the American Optical Sight Screener. That machine has the advantage of being convenient to use, but has these disadvantages: (1) It tests down to only 60 degrees; (2) the examiner has more difficulty in explaining to the candidate; (3) it has the same defect as the Keystone and A.A.A. machines, in that it does not have a sufficient "movement" feature.

A word about how errors of refraction affect the fields is advisable. Harrington has called attention to the fact that his test does not do well in uncorrected and corrected aphakia. It has also been noted by us in these experiments and in our office that people with high corrected or uncorrected errors of refraction are apt to have difficulty in the test. I have noted with tests on myself that I saw the patterns more clearly through the segments of my trifocals than in other parts of the field. All field of vision tests would be more exact if there was a single lens with correction adjusted to the distance tested; this, of course, is impractical.

Conservation of time in driver testing is needed. In the California questionnaire (above referred to) it was stated that it had been estimated that one minute added to the examination would necessitate the hiring of 18 more full-time employees. However, it must be stressed that too much emphasis on haste in field taking is definitely not advisable, for an improperly taken field is of less value than none at all.

My technician estimates that it takes about three minutes to adjust the patient, explain and do the test, and record the findings in the peripheral (horizontal only) screening tests by the A.A.A. apparatus or by the battery type instruments with field of vision attachments. The Harrington-Flocks Multiple Pattern method for central fields in all directions takes about two to three minutes to perform, and another two minutes to record if the results are found to be abnormal; this time can be lessened if our suggestions are followed. The confrontation test with fingers, or with a white ball (not a disc), can be done in one minute and easily recorded in another minute. I recommend that the white ball be one inch or more in diameter and be placed on a thin black or gray wand. The angle could be estimated reasonably accurately by a trained examiner and quickly recorded on a form with the four (or eight) directions printed for each eye.

The combination that would give the most information for the time spent would be to do both the multiple pattern and the confrontation tests; the two could be done and recorded in four to six minutes. During that time, the examiner could also get a definite

idea of the driver's thinking capacity as part of the total information desired in deciding whether to grant a license.

The estimates given here are for binocular tests.

Conclusions and Recommendations

From a study of the literature, from theoretical considerations, from a study of cases, and from personal road experiments, the following conclusions seem warranted:

1. Almost every accident can be logically ascribed wholly or partially to:

   A. Driver failure and defects such as improper attitude, psychotic personality, speed, unsafe driving habits, fatigue, alcohol intoxication, and the lack of sense of danger in the modern ultracomfortable car on smooth roads. This driver failure group is by far the more important.

   B. Defects in the car, road, illumination, traffic control, and the view available.

2. The paradox of the obvious need for some field of vision in driving and, withal, the lack of any reliable proof or statistics that field defects cause accidents except rarely, can be explained by these facts:

   A. There is usually no reasonable connection between a defective field of vision and the known causes of accidents listed above.

   B. A very small percentage of the drivers has a major field defect in either or both eyes.

   C. There is a tremendous increase in the practical fields of vision of even those with definite field defects by the movement of the eyes, head, and body.

   D. By means of mirrors much of the driver's peripheral field can be brought into his central field.

   E. Major field defects are frequently due to serious physical disease that, of itself, prevents an individual from driving.

   F. A driver who knows he has a handicap takes extra precautions.

   G. Most of the disabling field defects are associated with a loss of visual acuity which is below the limit permissible for a driver's license.

3. A full field of vision is, of course, valuable in driving. However, if a physically and mentally sound driver obeys the traffic laws, intelligently takes precautions, and has a visual acuity of 20/40 or better in his better eye, he can operate an automobile with reasonable safety if his total (nasal and temporal) binocular or monocular field is as low as 50 degrees.

4. However, an applicant with any consistent loss of a portion of his central field, or a constriction of the peripheral field to 50 degrees in any direction, should be referred to an ophthalmologist for a diagnosis and opinion, and should be re-examined every year.

5. Perhaps we may be permitted to make the unrealistic statement that the accident and death rate would be very low if all had poor visual acuity and narrow fields, and drove in a manner (particularly in regard to speed) that would be commensurate with such a hypothetical situation. *It is the liberties and habits of driving permitted by good vision that kill us.*

6. The quality of the central field is more important in driving than the quantity of the peripheral field, and the preference in testing should be given to the central field.

7. However, where funds and personnel are available, it would be well to test both the peripheral field and the central field. This would have the additional advantage of selling the driver the idea (which is so important) that he has a defect and that the motor vehicle department has a record of it.

8. A field of vision test should include the nasal field as well as the temporal, particularly if the left eye is defective.

9. The best screening apparatus yet offered to measure the central fields of drivers quickly is the Harrington-Flocks Multiple Pattern Method. As constructed, however, it tends to give too high a percentage of false positives in driver's examinations and it is recommended:

A. That it be done in an evenly and dimly lighted room away from extraneous influences; without haste.

B. That the inventors carry out their announced intention to modify the instrument for specific situations by (a) making fewer patterns, (b) using larger test objects in the patterns, (c) designing the patterns with the view of uncovering the quantity of the field lost rather than to give hints as to diagnosis.

C. That it be repeated on separate days.

10. In view of the shortage of personnel and the lack of evidence that field defects are a common cause of accidents, it would be well to restrict the testing to:

A. Accident repeaters, particularly intersection accidents.

B. Those with visual acuity on the border or below the passing level in either eye.

C. Drivers over the age of 70 years.

D. Those who in the course of other examinations lead the examiner to suspect field defects.

E. Drivers who cannot move the head and body easily, as in arthritis, or those with lack of normal movement of the eyes.

11. All disqualifying tests—and particularly field tests—should be repeated two or three times and should be consistent (see A.M.A. report).

12. Every state or large testing station should have:

A. A separate room for special tests such as fields, glare, co-ordination, and battery type vision tests.

B. A consulting ophthalmologist to supervise tests and to act as a referee and advisor.

13. I agree with previous writers who have urged that ophthalmologists should take more interest in safety, and should take time to acquaint their patients with defects which affect their driving. They should co-operate fully with the Drivers Bureau, and take seriously the job of examining drivers for a license. The oculist should have the courage to tell a patient with a disabling defect that he should not drive. Above all, as citizens, we should back up the law enforcement agencies and exert our influence toward decreasing the main causes of accidents, which fall largely in the areas of attitude, habits, and alertness.

Summary

This pilot paper has been written to indicate the many facets of the problem of the relationship of fields of vision to safety in driving. It would appear that defects in the driver's fields of vision are a very minor cause of accidents, but further research is needed in many areas to get a more complete answer.

Metropolitan Building (2).

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NOTES, CASES, INSTRUMENTS

SURGICAL CORRECTION OF COLLAPSED ANTERIOR CHAMBER*

FOLLOWING CATARACT EXTRACTION

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New York

Delayed formation or late collapse of the anterior chamber following cataract extraction still occurs in spite of our newly devised methods of closing the wound after extraction of the lens. The incidence of this dreaded complication has most certainly been drastically diminished by the use of more corneoscleral sutures. I find a minimum of four to a maximum of five corneoscleral 6-0 chromic catgut sutures placed before extraction of the lens a potent insurance against delayed closure or late collapse of the anterior chamber.

In my own technique, I use a limbal-based 5.0 mm. conjunctival flap and a shelved keratome section which is enlarged with Wescott scissors to somewhat more than 180 degrees. A complete iridectomy is performed following which the four or five 6-0 chromic gut sutures are placed through the conjunctival edge of the cornea (fig. 1) and then through the outer one third or one half of the scleral lip of the wound.

It is important that the corneoscleral suture is exactly aligned. To insure this alignment, the needle is pulled through the corneal bite and the suture is placed in a direct line over the scleral edge of the wound (fig. 2).

A landmark, such as a small scleral vessel, is decided upon for the scleral bite with the Grieshaber needle. The scleral edge is grasped with Saint Martin or Guyton forceps immediately adjacent to this landmark. The needle is now inserted through the scleral edge (fig. 2). I use only Grieshaber needles size 81-10 which are threaded by the assistant or by the nurse.

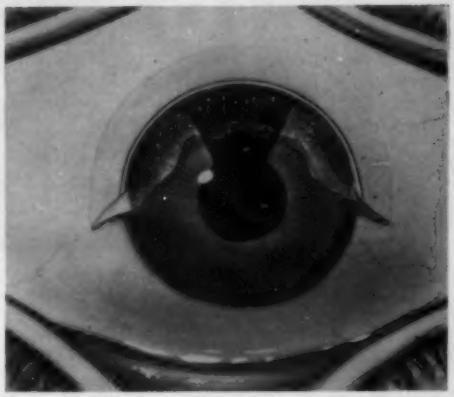

Fig. 1 (Laval). A complete iridectomy is performed.

A moistened gauze flap keeps the lower ends of the sutures in place over the patient's cheek and another gauze flap keeps the upper ends of the sutures in place over the patient's forehead. (fig. 3). These gauze flaps are kept moist and are a distinct aid in preventing the sutures from getting in the surgeon's way during the operation. An iris repositor is slipped into the anterior chamber between the corneal and scleral lips of the wound and enough of each suture is drawn out to make a loop large enough for the wound to open easily and allow the lens to be removed.

After the lens has been removed, using forceps or erisophake (my preference is for the erisophake), each of the upper ends of the four to five sutures is pulled taut making sure that the corresponding lower end of each suture is seen to move as the surgeon pulls on the corresponding upper end. This maneuver not only closes the wound snugly but also assures that all the loops have been pulled tight. Each suture is now tied tightly three times and cut short leaving a knot which will be buried under the conjunctival flap. At this time air can be injected into the anterior chamber through the corneoscleral wound under direct vision. The conjunctival flap is tied with a running 6-0 chromic

* From the Eye Service of Mount Sinai Hospital.

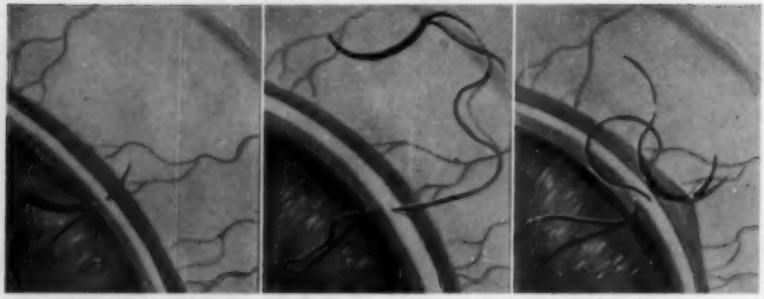

Fig. 2 (Laval). To insure exact alignment, the needle is pulled through the corneal bite and the suture is placed in a direct line over the scleral edge of the wound.

suture with a knot at each end of the suture.

Eserine is instilled and a monocular dressing is applied.

Since using this method on 90 ward and private patients, there has been one case of delayed formation of the anterior chamber and one case of late collapse of the anterior chamber. The delayed formation occurred in a patient who had had 0.5 cc. of streptomycin injected subconjunctivally in the lower fornix at the end of the operation. This caused a marked edema of all the tissues of the globe.

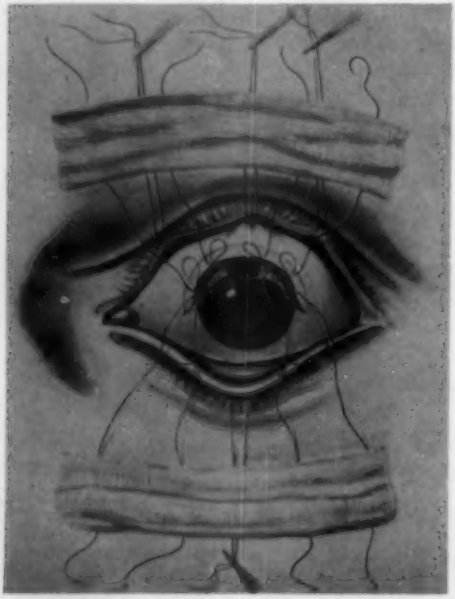

Fig. 3 (Laval). Moistened gauze flaps keep the ends of the sutures in place.

The late collapse occurred in a patient who was discharged to a convalescent home on the seventh postoperative day and was returned to the hospital two days later with a collapsed anterior chamber. In an attempt to reform the anterior chamber, eserine solution (0.25 percent) was instilled every four hours in the affected eye of the patient for four days to no avail.

In the patient with delayed formation of the anterior chamber, eserine was used daily for eight days with no success. In patients with this complication, the procedure almost invariably has resulted in a good anterior chamber after two to three days of frequent instillation of eserine drops, regardless of whether a round pupil or a complete iridectomy extraction had been performed.

In these two patients eserine was of no benefit. Both patients showed a detached choroid, one nasally and the other temporally. Accordingly, the following simple procedure was performed on both patients under intravenous pentothal anesthesia.

In the lower temporal aspect of the eye, between the lateral and inferior rectus muscles, the conjunctiva is incised 8.0 to 10 mm. from the limbus. Tenon's capsule is then incised with scissors to expose the sclera, and dissected to within 4.0 mm. from the limbus. At this point a scratch incision 5.0 mm. long is made into the sclera as for a cyclodialysis, using a Bark-Parker knife or a keratome.

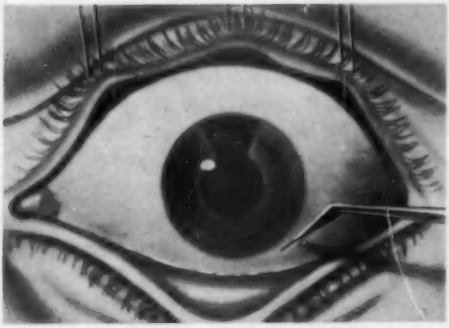

Fig. 4 (Laval). A scratch incision is made into the sclera as for a cyclodialysis.

I prefer the keratome (fig. 4). When the sclera is cut through, a goodly amount of clear fluid escapes from the suprachoroidal space whether or not the detached choroid is in the area where the operation is performed.

The lower outer quadrant is chosen because of the ease with which the operation can be performed in this area, even though the detached choroid may not be located there. The globe is now quite soft. The metal tip through which one ordinarily injects air into the anterior chamber at the end of a cataract operation is inserted through the scleral wound along the inner surface of the sclera into the anterior chamber (fig. 5). The anterior chamber is easily entered because no iris adhesions have yet occurred at the filtration angle.

Enough air is injected to push the vitreous and iris back from the posterior surface of the cornea. Because much fluid escapes when the scleral incision is performed, an increase

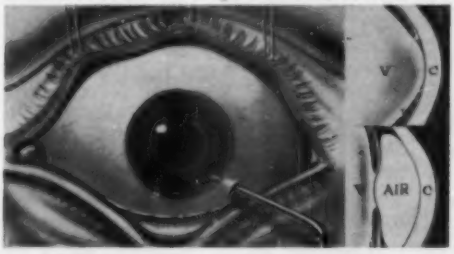

Fig. 5 (Laval). The metal tip of the air syringe is inserted through the scleral wound.

in the intraocular pressure is not to be feared as a result of the air in the anterior chamber. The conjunctival wound is closed with 6-0 black silk or with 4-0 plain catgut. I prefer plain catgut. Eserine is instilled and a monocular dressing is applied. At subsequent dressings, eserine is instilled for the first two postoperative days and thereafter 0.2-percent scopolamine, only as indicated.

A weak mydriatic is used postoperatively in cataract extractions and only as frequently as indicated, sometimes only once or twice a week. About two weeks postoperatively steroids can be instilled locally two or three times a day until the aqueous is clear of cells and the globe is white below. The upper portion is disregarded because the conjunctiva was incised in this area and it will take long to whiten anyhow. My preference is for one of the prednisone or prednisolone steroids.

Comment

The operative procedure here described is really a simple cyclodialysis, making the scleral incision 4.0 mm. from the limbus. Instead of thrusting a spatula into the anterior chamber to free the iris adhesions at the filtration angle, the air-injecting syringe is used and no attempt is made to free any of the iris at the angle. The operation is always performed at the lower temporal quadrant between the external and inferior rectus muscles.

One expects some bleeding when the conjunctiva is incised because the tissues are still quite boggy and inflamed 10 days after a cataract extraction. A firmly wound toothpick applicator soaked in adrenalin will decrease the bleeding and oozing sufficiently to carry out the operation quickly.

136 East 64th Street (21).

THE IRIDENCLEISIS BLEB

Alfred A. Nisbet, M.D.
San Antonio, Texas

Apparently there have been few attempts to obtain a completely unrestricted bed into

which the aqueous may filter following an iridencleisis operation. The object of this paper is to present a new procedure which will accomplish that.

Since the original description of iridencleisis by Holth,[1] there have been many modifications of the procedure, most of which have been related to the handling of the iris. The conjunctival flap has been of the hinged variety made either with scissors or a keratome. Priestley Smith[2] made parallel horizontal slits in the bulbar conjunctiva, one at the limbus and one fornixward. He then tunneled between the two slits and the iris was pulled into this tunnel. The conjunctival incisions were pinched with forceps and allowed to remain unsutured.

In 1913, R. Von Mende[3] and Dupuy-Dutemps,[4] after performing sclerectomies, pulled the bulbar conjunctiva down and sutured it to the cornea after denuding the limbus area there. Then, in 1930, Lundsgaard[5] reported two unsuccessful cases using this procedure; one followed a sclerectomy and the other an iridencleisis. In each, the conjunctiva did not adhere to the cornea microscopically although grossly it had appeared to do so. In performing trephining operations Verhoeff[6] attached the bulbar conjunctiva to the cornea with a suture tangential to the limbus (fig. 1).

In this new procedure an incision is made through the bulbar conjunctiva and sclera parallel to the limbus, usually at 12 o'clock. By placing it about 2.0 mm. from the clear cornea, the anterior chamber will be entered at about the chamber angle. If a more beveled incision is desired, it may be started in the sclera at a slightly greater distance from the

Fig. 1 (Nisbet). Diagrams of techniques described in literature.

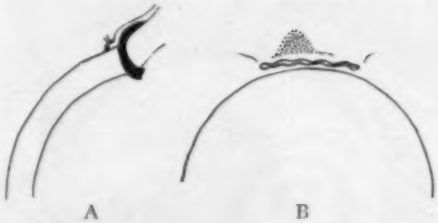

Fig. 2 (Nisbet). Diagram of technique described herein.

cornea. A controlled opening ab externo of sufficient length is made for convenient manipulation of the iris. An adequate conjunctival fringe remains on the corneal side.

Upon entering the anterior chamber, the iris usually bulges into the wound. If it does not do so, it may be brought out with forceps. Either one or two pillars of the iris may be incarcerated in an appropriate manner. A pocket is now made under the conjunctiva only sufficiently large that the exposed iris will remain flat on the sclera when the conjunctiva is brought to join the fringe on the corneal side of the incision.

Closure (fig. 2-A and B) is best accomplished by using a running mattress suture either tied or untied but pulled up well. Either absorbable or nonabsorbable suture is satisfactory. I prefer fine braided silk. This suture is allowed to remain in place about six days. A fluid-tight, closed, conjunctival incision results.

When a flap has been turned down, scarring results in that area. In addition, the incision line in the bulbar conjunctiva above the fistula frequently acts as a limiting boundary; so only the nasal and temporal ends of the flap area allow relatively free spread of fluid. One advantage of this new procedure is that filtration takes place in an unscarred area resulting in a diffuse noncystic bleb as illustrated by a one-pillar incarceration (fig. 3). This may be confirmed by observing the slight chemosis of the conjunctiva near the fistula. Tight closure of the conjunctiva on the corneal side of the filtra-

tion area and the slight resistance of unaltered conjunctiva seem to be conducive to rapid reformation of the anterior chamber.

A properly placed incision is always sufficiently posterior to allow a limbal fringe of conjunctiva which is adequate for easy suturing. Also any adhesion of this incision line is always on the limbus side of the scleral opening, thus an unrestricted filtration field is obtained above.

This is a new and uncomplicated method of handling bulbar conjunctiva for iridencleisis operations.

700 South McCullough.

Fig. 3 (Nisbet). Appearance of eye operated by present technique.

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2. Smith, D. Priestley: Iridencleisis modifications. Brit. J. Ophth., **30**:589-590 (Oct.) 1946.
3. Von Mende, R.: Zur Technigue der ellotschen Trepanation. Klin. Monatsbl. f. Augenh., **51**:56, 354, 1913.
4. Dupuy-Dutemps: Une modification a la technigue trepanation d'Elliott. Ann. ocul., **143**:409-413, 1913.
5. Lundsgaard, K. K., Conjunctival flap in sclerectomy and iridencleisis. Acta path. & microbiol. Scandinav, Supp. 3, pp. 269, 273, 1930.
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ATYPICAL TUMOR OF IRIS

REPORT OF A CASE

JUNIUS BRACY CROSS, M.D.
Little Rock, Arkansas

History. A 35-year-old white man was first seen by me in February, 1955. The presenting complaint was a slight blurring of distant vision and the presence of a yellow area of the right (nasal) iris. The blurring of vision had been of insidious onset over a period of months. The yellow area was first observed in 1939 much smaller than its present size (fig. 1). The patient had been aware of enlargement of the area but was not alarmed because of its insidious nature. There was no other history of ocular symptoms or visual disturbance.

Ocular examination. The iris tumor was

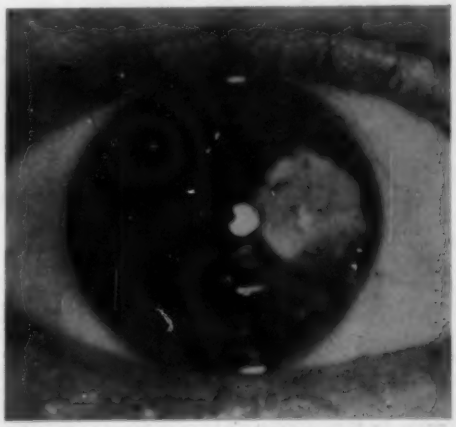

Fig. 1 (Cross). A large iris tumor, measuring (gross) 6.0 by 4.0 mm. The whitish area (measuring 3.5 mm. in diameter) represents the portion of the tumor in contact with the endothelium. The remaining portion of the tumor was dark pink and contained numerous vessels.

Fig. 2 (Cross). Postoperative appearance of the eye. A large iridectomy, including the tumor, was performed, using a nasal limbus incision with a conjunctival limbus-based flap.

in contact with the endothelium nasally and at the upper extent of the mass, and with the anterior lens capsule at the pupillary border. The pupil dilated irregularly with paredrine mydriasis. There was a tiny (one-half mm.) capsular opacity at the site of contact but the lens was otherwise uninvolved. The fundus was not remarkable. The ocular tension was 18 mm. Hg (Schiøtz) in this eye and 20 mm. Hg (Schiøtz) in the left eye. The visual acuity was (Snellen) right eye, 20/15−11, and left eye, 20/15.

Slitlamp examination. There was a slight bulge of the cornea over the tumor with a dull-yellow chalky appearance of the surface of the tumor in contact with the cornea. The corneal stroma in this region was quite clear. The mass in the anterior chamber was a dark-pink highly vascular structure. There was an opaque white area of the lens capsule, approximately one-half mm. in diameter at the site of contact with the tumor. The iris contained numerous vessels adjacent to the mass from the 1-o'clock to the 5-o'clock position, with a thickening of the iris stroma and a loss of the contraction furrows in this region. The remaining iris surface anatomy outside this region appeared normal. The left iris was not remarkable.

Course. The patient was admitted to the hospital and under local anesthesia a conjunctival limbus-based flap was made nasally. Preplaced McLean sutures were placed at the 2-o'clock and 4-o'clock positions. A scratch incision was made at the 2-o'clock position and enlarged with scissors to the 12- and 6-o'clock positions. The iris was grasped at the 12- and 6-o'clock positions and incised radially to the base of the iris. The iris then was torn from the radial incision to the edges of the mass. An iris spatula was inserted between the mass and the posterior cornea. The mass was easily delivered through the incision by gentle traction on the two iris columns. Basilar iridectomy was then completed by tearing. The McLean sutures were tied and the chamber reformed with saline. There was only a faint hemorrhage which did not obscure the iris or lens. The conjunctiva was approximated by continuous suture.

Postoperative course was uneventful. The patient was allowed to sit up the following day and discharged from the hospital on the seventh postoperative day.

Microscopic appearance

The entire tumor is quite vascular, densely cellular, and nonuniform in structure (fig.

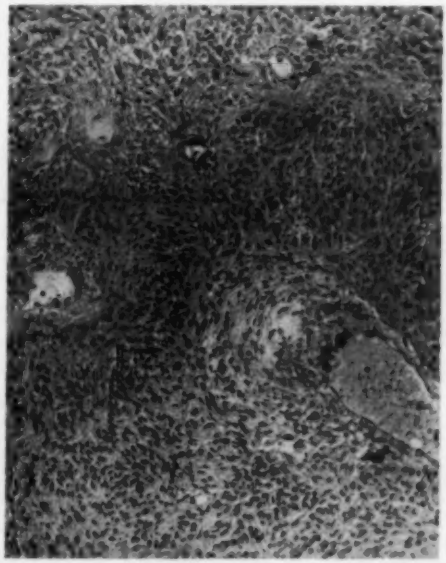

Fig. 3 (Cross). Photomicrograph, showing spindle-shaped, nonpigmented cells with distinct fibrillar cytoplasm resembling smooth muscle cells.

3). There are areas of elongated cells, spindle-shaped, with a fibrillar cytoplasm resembling smooth muscle cells. Other areas contain lightly pigmented round cells. The pigment appears as hemosiderin deposits and definite melanin in tumor cells in foci. The majority of cells in the tumor are nonpigmented. Some groups of foamy cells are seen. Distinct plastinian bodies are present within the nuclei of some tumor cells.

Postoperative course

Following the uneventful hospital course the patient has been observed at one to three month intervals and there has been no systemic or local recurrence.

The ocular tension has remained within normal limits. Visual acuity at present is 20/80, right eye, and 20/15, left eye. There is a large corneal leukoma in the deep corneal stroma over the area of the tumor site and an anterior lens capsular opacity at site of tumor contact (fig. 2). There are also numerous tiny pigment deposits on the anterior capsule in the region of the iridectomy which are gradually becoming less distinct. There is only a moderate complaint of light sensitivity. The visual acuity can be improved partially with a large hyperopic cylinder which the patient prefers not to wear.

Summary

An iris tumor of over 16 years' duration was removed. There was an indistinct histologic differentiation between nevus and leiomyoma in an apparently benign tumor. The follow-up to date has been a two-year period.

408 Boyle Building.

MODIFICATIONS OF KATZIN MASK

Clinton A. Wilson, M.D.
Los Angeles, California

The principal modification of the Katzin mask is to change it to a flexible form instead of the original rigid metal one. The material used so far has been the lead-impregnated rubber sheeting used by roentgenologists for aprons and other shielding.

The second modification is a two-mm. cut in the apex of each of the border notches. These little cuts hold fine silk well, do not weaken the silk, and free it easily. A light clamp may be used to weight the suture.

The simple modifications have proved quite useful and convenient during four years of trial in a variety of operations. The mask can now be molded to the general contour of the field and tends not to skid or slide. It is easily kept in place with a single towel clip. An unobtrusive handiness and stability are substituted for the rigidity of the otherwise well-designed original.

3875 Wilshire Boulevard (5)

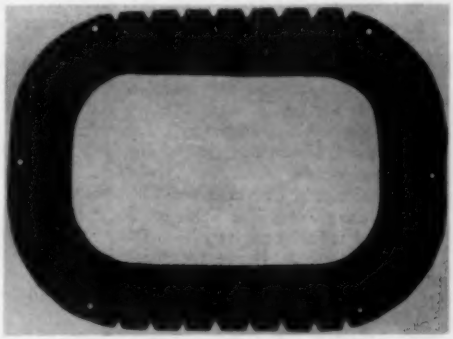

Fig. 1 (Wilson). Modified Katzin mask.

OPHTHALMIC RESEARCH

EDITED BY FRANK W. NEWELL, M.D.

Research Grants Program in Ophthalmology

of the

NATIONAL INSTITUTE OF NEUROLOGICAL DISEASES AND BLINDNESS
NATIONAL INSTITUTES OF HEALTH
Bethesda, Maryland

INVESTIGATOR AND INSTITUTION	TITLE OF PROJECT	AMOUNT
Stephen W. Kuffler, Johns Hopkins University, Baltimore, Maryland:	"Physiology of the visual system"	$18,486
Leon S. Stone, Yale University, New Haven, Connecticut:	"Regeneration of lens, iris, and retina"	10,648
Lorand V. Johnson, Western Reserve University, School of Medicine, Cleveland, Ohio:	"Nutrition, metabolism of avascular structures of eye"	10,762
Elsie Murray, Cornell University, Ithaca, New York:	"Color vision cross test standardization	5,400
A. Edward Maumenee, Johns Hopkins University, School of Medicine, Baltimore, Maryland:	"Study of the etiology and treatment of uveitis"	13,340
Michael J. Hogan, University of California, San Francisco, California:	"Investigation on ocular toxoplasmosis"	9,974
Irving H. Leopold, Wills Eye Hospital, Pennsylvania:	"Corticosteroids in the aqueous humor"	14,907
Arnall Patz, Georgetown University, Washington, D.C.:	"Oxygen studies in retrolental fibroplasia"	15,972
W. Morton Grant, Massachusetts Eye and Ear Infirmary, Boston, Massachusetts:	"Actions of chemicals injurious to eye"	11,712
Randall W. Reyer, University of Pittsburgh, Pittsburgh, Pennsylvania:	"Lens induction and lens regeneration"	4,046
Elmer J. Ballintine, Western Reserve University, Cleveland, Ohio:	"Secretory mechanisms of the ciliary body"	24,501
Albert M. Potts, Western Reserve University, School of Medicine, Cleveland, Ohio:	"Experimental and clinical electroretinography"	16,816
Aeleta N. Barber, Louisiana State University, Baton Rouge, Louisiana:	"Development of the human visual pathway"	19,448
A. Edward Maumenee, Johns Hopkins University, Baltimore, Maryland:	"Study of diabetic retinopathy"	20,000
Stephen Polyak, University of Chicago, Chicago, Illinois:	"The vertebrate visual system"	6,642
Chih Chiang Teng, Eye Bank for Sight Restoration, New York, New York:	"Anatomic study of the retinal periphery"	10,000
A. L. Kornzweig, Home for Aged and Infirm Hebrews of New York City, New York, New York:	"The eye in old age: A clinical and pathologic study"	16,152
K. W. Asher, University of Cincinnati, College of Medicine, Cincinnati, Ohio:	"Research on aqueous veins and on glaucoma"	6,578
Michael J. Hogan, University of California, Berkeley, California:	"Action of lytic enzymes on eye structures"	11,712
Charles I. Thomas, Western Reserve University, Cleveland, Ohio:	"Applications of radioactive isotopes to the eye"	12,000
John E. Harris, University of Oregon, School of Medicine, Portland, Oregon.	"Cations and hydration of the cornea and lens"	10,648
R. Winston Roberts, Wake Forest College, Bowman Gray School of Medicine, Wake Forest, North Carolina:	"Glaucoma study"	4,427
W. Morton Grant, Massachusetts Eye & Ear Infirmary, Boston, Massachusetts:	"Study of pressure regulating mechanisms in glaucoma"	14,030
Ralph G. Janes, State University of Iowa, Iowa City, Iowa:	"Ocular changes in diabetic animals"	7,219
James C. Peskin, University of Rochester, Rochester, New York:	"Carotenoid and protein in the visual receptor system"	4,549

Investigator and Institution	Title of Project	Amount
Otto Lowenstein, College of Physicians & Surgeons, Columbia University, New York, New York:	"Autonomous nervous system by pupillography"	13,800
Albert C. Snell, Jr., University of Rochester, Rochester, New York:	"Reactions of the iris to injury"	6,343
Charles Haig, New York Medical College, New York, New York:	"Spectral sensitivity function in congenital stationary night blindness"	540
Hermann M. Burian, State University of Iowa, Iowa City, Iowa:	"Electrical responses of human visual system"	26,738
Jerome J. Wolken, Eye & Ear Hospital, University of Pittsburgh, Medical Center, Pittsburgh, Pennsylvania:	"Photoreceptor structures in biological systems"	10,195
Oliver H. Lowry, Washington University, Saint Louis, Missouri:	"Quantitative histochemistry of the retina"	6,980
Marie A. Jakus, Retina Foundation, Boston, Massachusetts:	"Investigation of fine structure of ocular tissue"	15,628
S. Rodman Irvine, University of California, Berkeley, California:	"Surgery of detached retina"	11,996
K. Scharenberg, University of Michigan, Ann Arbor, Michigan:	"Investigation of the human eye with the silver carbonate method"	9,775
George K. Smelser, Columbia University, New York, New York:	"Histochemical differentiation of the eye"	8,018
Jack H. Prince, Ohio State University, Columbus, Ohio:	"Visual screening tests"	2,070
H. V. Platou, Southern Eye Bank:	"Co-operative study on retrolental fibroplasia"	19,222
Alexander Forbes, Individual, Harvard University, Cambridge, Massachusetts:	"Spectral sensitivity of turtle retina"	4,000
T. F. Schlaegel, Jr., Indiana University, Research Foundation, Indianapolis, Indiana:	"Studies on toxoplasmic uveitis"	7,986
Heinz Hermann, University of Colorado, Medical Center, Denver, Colorado:	"Biochemical and cytologic study of muscle tissue"	7,475
		21,296
Frederick Crescitelli, University of California, Los Angeles, California:	"A comparative study of visual pigments"	2,129
George Wald, Harvard University, Cambridge, Massachusetts:	"Chemistry of vision"	8,660
A. Leonard Diamond, Northwestern University, Evanston, Illinois:	"Simultaneous brightness contrast"	6,521
Albert M. Potts, Western Reserve University, Cleveland, Ohio:	"Toxic amblyopias" $13,334 (F.Y. '56)	5,709
		23,512
Ernest Jawetz, University of California, School of Medicine, San Francisco, California:	"Studies of viral keratoconjunctivitis"	20,357
Bernard Becker, Washington University, Saint Louis, Missouri:	"Rate of flow of aqueous humor in the rabbit eye"	24,490
Robert M. Boynton, University of Rochester, Rochester, New York:	"Chromatic adaptation and stray light in vision"	11,500
Wendell D. Gingrich, University of Texas, Medical Branch, Austin, Texas:	"Irradiation of the ciliary body of the eye"	10,386
Charles L. Schepens, Massachusetts Eye & Ear Infirmary, Boston, Massachusetts:	"Study of certain aspects of uveitis"	16,317
Leona Zacharias, Massachusetts Eye & Ear Infirmary, Boston, Massachusetts:	"Study of mild and severe retrolental fibroplasia"	14,375
Philip B. Armstrong, Marine Biological Laboratory, Woods Hole, Massachusetts:	"Encephalization in embryonic development"	2,637
Arthur Jampolsky, Stanford University, School of Medicine, San Francisco, California:	"Investigation of ocular divergence mechanisms"	7,342
J. W. Bettman, Stanford University, San Francisco, California:	"Vasodilator and vasoconstrictor drugs on intraocular circulation"	3,862
Harry Green, Wills Eye Hospital, Philadelphia, Pennsylvania:	"Investigation of lens metabolism"	10,292
Samuel Kaplan, Children's Hospital, Research Foundation, Cincinnati, Ohio:	"Measurement of oxygen tension in infants"	9,562
David G. Fleming, University of Kansas, Lawrence, Kansas:	"Vascular factors in visual accommodation"	4,255
Ludvig G. Browman, Montana State University, Missoula, Montana:	"Blood supply in embryos of microphthalmic rats"	3,000

Investigator and Institution	Title of Project	Amount
J. R. Couch, Texas Agriculture Experimental Station and University of Texas Medical School, Austin, Texas	"Vitamin E and the embryonic development of the eye"	8,584
		1,119
Kay T. Rogers, Oberlin College, Oberlin, Ohio	"Research in neuroembryology"	575
Austin H. Riesen, University of Chicago, Chicago, Illinois	"Co-ordinated ocular fixation and convergence movements"	7,452
Henry Dolger, Mount Sinai Hospital, New York, New York	"Diabetic retinopathy and vitamin B_{12}"	3,214
Austin H. Riesen, University of Chicago, Chicago, Illinois	"Retinal atrophy after light deprivation"	11,640
Algernon B. Reese, Columbia University, New York, New York	"Cytology and biochemistry of human pigmented ocular tissue"	11,712
Arnold Lazarow, University of Minnesota, Minneapolis, Minnesota	"Study of diabetic retinopathy"	21,296
William van Herick, University of California, Berkeley, California	"Studies on ocular toxoplasmosis"	9,373
John R. Harrison, Miami University, Miami, Florida	"Growth and differentiation of the chick embryo eye"	1,316
Frank W. Newell, University of Chicago, School of Medicine, Chicago, Illinois	"Electro-oculographic recording of nystagmus"	2,875
Louise Sloan Rowland, Wilmer Ophthalmological Institute, Baltimore, Maryland.	"Light sense perimetry in physiologic optics"	8,915
William John Holmes, Department of Health, Territory of Hawaii, Honolulu, Hawaii	"Prevention and treatment of ocular leprosy"	3,500
Werner K. Noell, Health Research, Inc., Roswell Park Division, Buffalo, New York	"Metabolic and functional development of the retina"	16,928
T. F. Schlaegel, Jr., Indiana University Medical School, Indianapolis, Indiana	"Emotional factors in uveitis and glaucoma patients"	9,372
George Wald, Harvard University, Cambridge, Massachusetts	"Mechanisms of cone and color vision"	7,667
S. Rodman Irvine, University of California, Los Angeles, California	"Hyaluronic acid-hyaluronidase balance in ocular tissue"	14,883
Wood Lyda, University of Washington, Seattle, Washington	"Endophthalmitis phacoanaphylactica"	5,750
Haldon K. Hartline, Rockefeller Institute for Medical Research, New York, New York	"Electrical activity of single receptors and neurones of the eye"	15,968
George Clark, University of Buffalo, Buffalo, New York.	"The neural basis for flicker phenomena in the cat"	7,325
Alfred J. Coulombre, Yale University, School of Medicine, New Haven, Connecticut	"Intraocular pressure in growth of vertebrate eye"	5,324
Milton Flocks, Stanford University, San Francisco, California	"Physiology and anatomy of trabecular meshwork"	10,925
Aeleta N. Barber, Louisiana State University, Baton Rouge, Louisiana	"Congenital blindness"	5,445
Gertrude Rand, Columbia University, New York, New York	"Electroretinogram and flicker fusion"	6,921
Ronan O'Rahilly, Wayne University, College of Medicine, Detroit, Michigan	"Histochemical studies in ophthalmic developments"	6,727
Endre A. Balazs, Retina Foundation, Boston, Massachusetts	"Nuclear magnetic resonance studies"	9,814
Goodwin M. Breinin, New York University, Bellevue Medical Center, New York, New York	"Electromyography of the extraocular muscles"	14,835
Ward C. Halstead, University of Chicago, Chicago, Illinois	"Factors in mental development of young blind children"	21,907
Robert M. Sinskey, University of California, Medical School, Los Angeles, California	"Studies on the absorption of hyphemas"	15,305
Paul B. Porter, University of Utah, Salt Lake City, Utah	"Physiologic study of visual cortex"	10,630
E. Carl Sensenig, University of Alabama, Medical Center, University, Alabama	"Development of visual and auditory centers in embryos"	8,616
H. Richard Blackwell, University of Michigan, Ann Arbor, Michigan	"Electrophysiology of color vision"	12,851
John Harry King, Jr., Georgetown University, Medical Center, Washington, D.C.	"Corneal preservation by dehydration"	11,845
Paul R. Patek, University of Southern California, Los Angeles, California	"Lymphatic and circulatory pathways of the eye"	2,967

Investigator and Institution	Title of Project	Amount
Don Wood, University of Utah, Salt Lake City, Utah	"Effect of antibodies on fetal differentiation"	6,843
Lillian S. Kumnick, Lenox Hill Hospital, New York, New York	"Pupillographic studies"	10,183
Gilbert Baum, New York University, Bellevue Medical Center, New York, New York	"Application of ultrasonic locating to ophthalmology"	12,650
Adolph W. Vogel, Wills Eye Hospital, Philadelphia, Pennsylvania	"Intralenticular implantations of various compounds"	5,400
Carlton E. Melton, Southwestern Medical School, University of Texas, Austin, Texas	"Action and innervation of ciliary muscle"	9,406
Donald D. Lindsley, University of California, Los Angeles, California	"Central co-ordination of eye movements"	18,961
Olive Fedde Erickson, Stanford University, San Francisco, California	"Lacrimal protein: paper electrophoresis (tears)"	12,317
Wilfred Roth, Roth Laboratory of Physical Research, Hartford, Connecticut	"Viscoelastic properties of the eye"	7,924
Seymour P. Halbert, Columbia University, New York, New York.	"Immunologic observations on ocular lens in cataract"	11,270
Benjamin Rones, Episcopal Eye, Ear & Throat Hospital, Washington, D.C.	"Clinicopathologic study of iris tumors"	9,250
Howard P. Krieger, Mount Sinai Hospital, New York, New York	"Physiologic basis of repetitive eye movements"	9,023
Jan H. Bruell, Highland View Cuyahoga County Hospital, Cleveland Heights, Ohio	"Visual space perception and neurologic impairment"	13,972
Frederick C. Goetz, University of Minnesota, Minneapolis, Minnesota	"Clinical and physiologic studies of diabetes patients"	9,200
Joseph W. Hallett, Wills Eye Hospital, Philadelphia, Pennsylvania	"Relationship of streptococcal exotoxins to uveitis"	13,100
Jerry H. Jacobson, New York Eye and Ear Infirmary, New York, New York	"Electrophysiology of ciliary muscle"	11,587
Michael J. Hogan, University of California, San Francisco, California	"Investigations on endogenous uveitis"	29,084
V. Everett Kinsey, Kresge Eye Institute, Detroit, Michigan	"Intraocular fluid dynamics"	17,681
H. H. Chi, Eye-Bank for Sight Restoration, Inc., New York, New York	"Histology of connective tissues in the eye"	10,000
John M. McLean, Cornell University, Medical College, New York, New York	"Electrical currents in eye surgery"	13,908
George R. Merriam, Jr., Columbia University, New York, New York	"Lens proteins in radiation cataracts"	10,304
Endre A. Balazs, Retina Foundation, Boston, Massachusetts	"Structure, development and metabolism of vitreous body"	42,619
Nicholas G. Georgiade, Duke University, Durham, North Carolina	"Prolonged preservation of corneal grafts in a viable state"	6,819
Frank C. Winter, Palo Alto Medical Research Foundation, Palo Alto, California	"Differential effect of gamma radiation on retinal and choroidal vessels"	1,898
Ernest Gardner, Wayne University College of Medicine, Detroit, Michigan	"Collection of squirrels with pure cone retina"	2,185
Derrick Vail, Northwestern University, School of Medicine, Chicago, Illinois	"Effect of hallucinogens on electroretinogram"	15,491
Derrick Vail, Northwestern University, School of Medicine, Chicago, Illinois.	"Protein metabolism of refractory media of the eye"	24,322
Derrick Vail, Northwestern University, School of Medicine, Chicago, Illinois	"Electroretinography"	2,058
Jerry Hart Jacobson, Albert Einstein College of Medicine, New York, New York	"Effect of hallucinogenic drugs on electroretinogram"	15,289
Ernest Gardner, Wayne University, College of Medicine, Detroit, Michigan	"Visual systems, pure rod and cone retinae"	27,772
George K. Smelser, College of Physicians and Surgeons, Columbia University, New York, New York	"Electron microscopy of the eye and cardiovascular system"	38,807
Robert B. Sleight, Applied Psychology Corporation, Washington, D.C.	"Human engineering the work of the blind"	2,219
Robert B. Dienst, Medical College of Georgia, Augusta, Georgia	"Acquired ocular toxoplasmosis"	8,165
Michael J. Hogan, University of California, San Francisco, California	"Electron micrography of the limbs"	13,888

Investigator and Institution	Title of Project	Amount
T. F. Schlaegel, Indiana University, Indianapolis, Indiana	"The Middlebrook-Dubois test in endogenous uveitis"	7,500
R. W. Ditchburn, Reading University, Berks, Great Britain	"Function of eye movements in relation to visual perception"	12,700
Terrence H. Cochran, University of Utah, Salt Lake City, Utah	"Factors in organ growth"	8,526
T. C. Ruch, University of Washington, Seattle, Washington	"Effect of restricted visual space on ocular functions"	2,300
L. Byerly Holt, Marguerite Barr Moon Eye Research Foundation, Inc., Winston-Salem, North Carolina	"Corneal implant and transplant"	18,682
Ted Suie, Ohio University, Research Foundation, Columbus, Ohio	"Immunology of experimental ocular inflammation"	5,324
T. F. Schlaegel, Jr., Indiana University, Foundation Research Division, Indianapolis, Indiana	"Autonomic conditioning in hysterical amblyopia"	2,300
Donald Kennedy, Syracuse University, Syracuse, New York	"Studies on the crayfish caudal photoreceptor"	2,300
Tom N. Cornsweet, Yale University, New Haven, Connecticut.	"Recording very small eye movements"	2,277
R. H. Rigdon, University of Texas, Medical Branch, Austin, Texas	"Study of opacities in lens of chicken eye following injection of dinitrophenol"	2,300
James H. Allen, Tulane University, School of Medicine, New Orleans, Louisiana	"The mechanism of pseudomonas ocular infections"	10,301
Goodwin M. Breinin, New York University, Bellevue Medical Center, New York, New York	"Optical and electrophysiologic studies in accommodation and convergence"	19,159
M. Puig Solanes, General Hospital, Mexico City, D.F., Mexico	"Intraocular pressure in Indians, 'Mestizos' and Whites"	6,654
Tom N. Cornsweet, Yale University, New Haven, Connecticut	"Vision as a function of motion of the retinal image"	6,542
James E. Miller, Washington University, Saint Louis, Missouri	"Electromyographic study of oculomotor function"	21,597
J. Mandelbaum, State University of New York, New York	"Rod function at photopic illumination levels"	2,300
Fred N. White, University of Houston, Houston, Texas	"Ciliary blood volume-accommodation relationship"	2,142

The Association for Research in Ophthalmology

Future Meetings

Western Section:	San Francisco, California, November, 1957 Levon Garron, M.D., chairman, 426 17th Street, Oakland 12, California
Southern Section:	Miami Beach, Florida, November 12, 1957 Sherman B. Forbes, M.D., chairman, 706 Franklin Street, Tampa 2, Florida
East Central Section:	Cleveland, Ohio, January 7, 1958 Albert M. Potts, M.D., chairman, University Hospitals, 2065 Adelbert Road, Cleveland 6, Ohio
Eastern Section:	Bethesda, Maryland, January 17, 18, 1958 Ludwig von Sallmann, M.D., chairman, National Institute of Neurological Diseases and Blindness, Bethesda 14, Maryland
Midwestern Section:	Saint Louis, Missouri, April 21, 1958 Bernard Becker, M.D., chairman, 640 South Kingshighway Boulevard, Saint Louis, Missouri
National Meeting:	San Francisco, California, June, 1958 Lorand V. Johnson, M.D., secretary, 10515 Carnegie Avenue, Cleveland 6, Ohio

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

434th Meeting

January 16, 1957

DR. EDWARD A. CRAMTON, *presiding*

APPARATUS FOR GRADING VISUAL ACUITY

DR. GORMAN presented a paper entitled "An apparatus for grading the visual acuity of infants on the basis of opticokinetic nystagmus (By John Gorman, M.D., David G. Cogan, M.D., and Sydney Gellis, M.D.): Opticokinetic nystagmus cannot be elicited in infants consistently by the methods usually used in adults because they all demand cooperation in the form of attention beyond an infant's capability.

An apparatus has been devised which is effective in eliciting the response even in very young infants. Its effectiveness is due to the fact that it encompasses most of the field of vision so that the infant cannot escape the stimulus.

The apparatus consists of a long, nine inch wide, strip of rolled white paper which is reeled over two transparent arches under which the infant lies. The distance from the eyes to any point on the arch of the paper is approximately six inches. Across the width of the paper are printed black lines. In this study the lines on the first eight feet were spaced at 0.02 inch intervals and at 0.055 inch intervals on the second eight feet. The 0.02 interval subtends approximately the same angle at the infant's eye as the intervals of a standard Snellen figure corresponding to a notation of 20/222. the 0.055 interval corresponds to 20/614.

One hundred newborns were exposed to the slowly passing (0.9 inches per second) line patterns. None responded to the 0.02 pattern, but 93 infants responded with nystagmus to the 0.055 pattern. Because such young infants do not have the necessary ocular neuromuscular control to allow them to track the intervals with perfect precision, we cannot accept a positive response as an indication of the lower limit of acuity. The discrepancy between the speed of the paper and a slower eye speed would produce a "relative" increase in angular velocity which would reduce the perceptibility of the pattern below its static value.

In view of the above and excluding other factors, a positive response would appear to indicate that the visual acuity is probably no lower than that indicated by the ability to perceive the pattern if it were stationary. In this case, that ability would correspond to a standard Snellen notation of 20/614. It may be even better than this but at the present we don't have a large enough range of line patterns with which to test.

Conclusion. (1) An apparatus for grading the visual acuity of infants by means of the opticokinetic response has been described. Not only is the apparatus useful for determining the visual acuity but it should also be of considerable value in determining the presence or absence of vision. While lack of response is not final proof of blindness, a positive response definitely indicates the presence of vision. (2) Ninety-three of 100 newborns, one and one-half hours to five days of age were found to respond with nystagmus to a moving pattern, the intervals of which subtended an angle equal to that represented by a Snellen notation of 20/614. This index may be found to be lower when the study is repeated using a full range of line patterns.

Discussion. DR. DAVID G. COGAN: It is of academic interest to know when the opticokinetic response starts. Dr. Gorman has gotten as near the moment of delivery as possible and he has had good responses. This has a practical value of eventually being able

to determine the visual acuity of infants objectively. Dr. Gorman's big problem now is in calibrating it. You just can't take the angle subtended by the stripes and use the Snellen criteria because of the fact that it is moving. Also we don't know that the ocular motor mechanism of the child is adequate even though the acuity is. You all appreciate how this measures the acuity. As you grade down the stripes to smaller and smaller we all get to the stage where we see a uniform gray when we can no longer distinguish the black and white stripes. With the uniform gray there wouldn't be any fixational reflexes and we wouldn't get any opticokinetic response. Whereas when we can just distinguish the black and white then we get the ocular motor response indicated by the movements. Maybe the only way to calibrate it would be by taking children of known visual acuity and seeing what responses they give. This might be better than trying to do it on a theoretical basis.

Vitamin A and the eye

Mr. John Dowling: The important role vitamin A plays in the visual process was reviewed. A review was also given of former experiments on vitamin A and night blindness. The experimenters elected to attack the problem again, this time using new techniques and ideas.

A series of rats were raised on a purified vitamin-A deficient diet and it was attempted to examine all aspects of the deficiency with respect to the eyes. Biochemically the rhodopsin and opsin levels were measured and the liver and blood vitamin A. Physiologically, sensitivity to light was examined by electroretinogram techniques. Preliminary results seemed to resolve some of the inconsistencies mentioned in the literature.

It was found that diminished sensitivity occurred relatively early in young, growing rats on the deficient diet, as measured by electroretinography. Yet, externally the rats and their eyes appeared normal. Examination of blood vitamin A revealed diminished concentrations but significantly it was still present. The values were only one third to one half of that found in normal rats. The liver stores were depleted and the rhodopsin levels in the eye were significantly reduced.

From these first observations it was concluded that diminished adaption is a real and constant change in mild vitamin-A deficiency. It could also be said that depletion of the liver must be quite advanced before eye sensitivity is affected. It was also concluded, after a review of the role opsin plays in the chemistry of vision, that continued diminished sensitivity after alleviation of the deficiency may be attributable to degenerations of the opsin protein. Opsin is as important as vitamin A and retinene as a precursor of rhodopsin and changes in it or in its normal metabolism may lead to ocular defect.

Discussion. Dr. George Wald: The only physiologic effect of vitamin-A deficiency that one understands biochemically is this effect in the eye. But nobody dies of night blindness and one dies eventually, any animal, of vitamin-A deficiency. In long continued vitamin-A deficiency there is a general deterioration of epithelial surfaces all over the body. No one yet has the faintest idea what vitamin A has to do with maintaining epithelia, but it may be that these experiments will provide a first model for this. As vitamin A leaves the outer segments of the retina's rods and cones and the protein which is an important structural element of these cells begins to deteriorate and with that the cells deteriorate, one cannot help but wonder if elsewhere in the body there may be very important structural proteins of cells which if as long as they are kept occupied by vitamin A can maintain themselves, but in vitamin-A deficiency the proteins begin to go and with that perhaps the cell as a whole.

Charles Snyder,
Recorder.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

November 15, 1956

Dr. I. S. Tassman, *chairman*

The XIX Annual deSchweinitz Lecture

Dr. Alson E. Braley, Iowa City, Iowa, delivered the lecture entitled "Central serous choroidosis associated with amebiasis: A record of nine cases." His co-author was Dr. Henry E. Hamilton.

Choroiditis and amebiasis

An abstract of the paper follows: The gradual loss of central vision is disastrous to the patient and when associated with a central choroidosis or retinitis is commonly progressive and fails to respond to treatment, resulting ultimately in a central scotoma. The cause is ordinarily unknown. This paper reports nine patients who were found to have a central or macular lesion and also evidence of amebiasis. When treated properly for amebiasis, progression of the central lesion was stopped and healing took place. The patients under consideration came to the ophthalmologists because of loss of vision and were found to have a macular lesion.

The patients were studied carefully for evidence of tuberculosis, syphilis, brucellosis, histoplasmosis, lupus erythematosus, diabetes, lymphoma, malaria and other associated diseases by appropriate laboratory tests and clinical course.

All cases were found to have good clinical evidence compatible with active amebiasis. This, I think, may be important in the pathogenesis of the eye lesion. Six patients had positive stools for endomeba histolytica. The other three, however, had varied histories with bowel symptoms, were chronically ill, had enlarged tender livers, coppery color of the skin, colitis by sigmoidoscope and all a positive compliment fixation test, the latter became negative with treatment.

The clinical illness of amebiasis responded to therapy with eventual recovery following repeated courses of combined treatment with Diodoquin, Chloroquin and/or Carbarsone. After we had established a diagnosis of amebiasis, antibiotics were not used.

The following points concerning the clinical course of the eye lesion will be made. These cystic, pigmented, hemorrhagic lesions progressed unabated when the patients had been treated previously with typhoid vaccine, antibiotics, aureomycin, terramycin, streptomycin, penicillin and also histamine. They were made worse with ACTH and/or cortisone. It was also noted that between early courses of treatment with more specific antiamebic drugs, some progression was occasionally noted, but also appeared to be coincident with recurrent symptoms of clinical amebiasis. With multiple courses of antiamebic drugs, the lesion became quiescent in a few weeks to a few months and healed. The patients had been followed from over one to seven years. The lesions were bilateral in four and unilateral in five cases. The amebic infection was thought to antidate the eye lesion ordinarily by one to several years.

Summary. Nine patients are presented with lesions of the macula characterized by cystic elevation, hemorrhage, and pigment and also each patient had evidence compatible with active amebiasis.

The treatment with multiple courses of antiamebic drugs resulted in healing of macular lesions and arrest of the visual loss and with occasional improvement of vision.

The lesion was made worse with ACTH and cortisone.

It is suggested that all patients presenting a macular lesion of obscure etiology be studied for evidence of amebiasis.

William E. Krewson, 3rd,
Clerk.

AMERICAN JOURNAL OF OPHTHALMOLOGY

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SAN DIEGO GLAUCOMA SURVEY

Various methods have been used in screening for glaucoma such as "Glaucoma Day" surveys, surveys in industrial plants of all employees, screening in medical clinics of all patients, and so forth. The San Diego glaucoma survey suggests another method of screening for glaucoma which, to the best of our knowledge, has not been reported in the literature.

The San Diego glaucoma survey was unique in as much as it was a 10-day continuous survey conducted at a county fair. While this type of survey is not entirely original, we have not found any previous description of the methods used and the

problems concerned with putting on such a survey. This survey was conducted at the San Diego County Fair, Del Mar, California, June 28 through July 7, 1957. Four-hundred square feet of floor space was rented in one of the commercial exhibit buildings and a booth was set up under the sponsorship of the San Diego County Medical Society and staffed by the San Diego Ophthalmological Society members. Twenty-three ophthalmologists and 40 assistants manned the booth for 12 hours a day for the 10 full days of the fair.

As with all "Glaucoma Day" surveys, this survey was given advance publicity in the local papers, on the radio, and on TV. The local press and radio facilities were more than generous with space and time for publicity, and it was their co-operation that made the program such a success. All of the local opticians were called upon for assistance and donated equipment and personnel. The women's auxiliary of the medical society provided additional personnel. Two of the pharmaceutical companies donated the local anesthetic agents used in taking the tensions.

In the course of the survey, 3,986 persons were tested and 196 were found to have intraocular-pressure measurements of 28 mm. Hg or higher in one or both eyes. That is 4.97 percent were classed as positive and were advised to consult their ophthalmologist for further studies (table 1). This

TABLE 1

Number of people tested	3,986
Number with elevated tension, one or both eyes	196
Number of people reporting for follow-up in first month	35
Number of follow-up patients proved positive	14
Number unreported	161
Previously known glaucoma	9

original figure is higher than the two-percent positive reported by the Philadelphia glaucoma survey[1] and the 1.87 percent of the Cleveland survey.[2]

The follow-up study at one month showed that 35 of the original 196 suspected cases, or 17 percent, had consulted an ophthalmologist. Of this group there were 14 proven cases of glaucoma and 21 negative cases. Projecting this figure to the total number of positive cases, assuming that the ratio will remain the same, one gets a positive percentage of approximately 1.8 percent which is about the same percentage of positive cases as had been determined in other surveys.[1-3] In addition to the 196 suspected cases there were nine known positive patients who wanted a check of their tension.

The method of evaluation used in this survey was of necessity simple and is open to criticism. However, the object of the survey was to test as many persons as possible in the limited circumstances and this aim was fulfilled. We limited our screening procedure to a determination of the best visual acuity possible, as measured with a standard projector, and a measurement of the intraocular pressure with a Schiøtz tonometer.

All persons tested filled out a registration card giving their name, address, sex, color, age, and history of glaucoma in the family. Next their vision was tested, with the best vision possible being recorded. After this a drop of 0.5-percent Tetracaine HCl, or 0.4-percent Benoxinate HCl (Dorsacaine) was instilled in each eye. Following the drops the intraocular pressure was measured by one of the three recently standardized Schiøtz type tonometers, and this was recorded on the registration card. All tensions were taken with the patient reclining on a couch. The individual tested was then informed if the tension was elevated or normal, and was given the National Society for the Prevention of Blindness pamphlet, entitled *Glaucoma*, to take home. A giantscope was available for use at all times but the pressure of the line of persons waiting to be tested limited its use.

A follow-up study of the survey was made at one month and the result was as already noted. The long-term follow-up study will be conducted with the co-operation of the San

Diego County Medical Society. It is anticipated that a form letter will be sent out by the medical society to all persons in the positive group who have not reported to one of the local ophthalmologists, and the person will be reminded that it is to his advantage to have his eyes checked for glaucoma. A postcard will be attached to this letter to be returned to the Glaucoma Survey committee by the eye doctor consulted, giving the findings. This latter procedure has been used with success in "Glaucoma Day" follow-up studies.

The enthusiastic public response to the San Diego glaucoma survey would indicate that the public is taking a greater interest in health than ever before and is being made aware of the dangers of blindness from glaucoma. In other glaucoma surveys in recent years the public response has far exceeded the expectations of the physicians. It is, therefore, a real challenge to the ophthalmologists to make a more determined effort to find persons with early glaucoma who can be saved from loss of vision by medical and surgical treatment. In this day, when our professional standards are being challenged and encroached upon we ophthalmologists cannot do enough to make the public aware of the advantage of medical eye care.

John L. Power, M.D.,
Chairman
Glaucoma Survey Committee
San Diego Ophthalmological Society
San Diego 1, California

References

1. Brav, S. S., and Kirber, H. P.: Mass screening for glaucoma. J.A.M.A., **147**:1127-1128, 1951.
2. Wolpaw, B. J., and Sherman, A. W.: Cleveland glaucoma survey. Sight-Saving Rev., **24**:139-144, 1954.
3. Lancaster, W. B., and Foote, F. M.: The battle against blindness. J.A.M.A., **145**:26-29, 1951.

CORRESPONDENCE

System of symbols for intraocular dynamics

Editor,

American Journal of Ophthalmology:

In the past few years the treatment of intraocular dynamics in mathematical terms has become increasingly popular. Unfortunately, although there is little disagreement as to the form the equations should take, the tendency has been for a different set of symbols to be brought into use in each laboratory. This was not too serious when the exchange of substances between the blood and aqueous humor alone was being considered. Now, however, the exchanges between all the tissues and fluids of the eye are being formulated in terms of a dozen or more constants, and much unnecessary confusion would be avoided if a uniform and logical system of symbols were employed.

Accordingly, we developed a system which we circulated to those workers we knew to be active in the field. Apart from some criticism of detail it found a ready acceptance. The scheme has been modified to take account of these criticisms, and it now has the following form which we hope will be generally useful.

Each tissue or fluid is represented by a letter in subscript

- a Anterior aqueous humor
- h Posterior aqueous humor (hind, humor, Hinterkammer)
- v Vitreous humor
- c Cornea
- l Lens
- i Iris
- z Ciliary body (Ziliarkorper)
- p Plasma
- d Tears (Dacryon)

Their volumes and masses to be represented by V and M. Thus: V_a, M_i (volume anterior aqueous humor, mass of iris).

The interfacial areas between them by A,

thus: A_{ac} (area of posterior corneal surface).

The mass of a substance in a tissue or fluid by m. Thus: m_c (mass of substance in cornea) and m_{ac}, m_{ca} (net mass moved from aqueous humor to cornea, and *vice versa*).

The concentration of a substance in a tissue expressed as mass of substance per unit mass tissue by C, and expressed as mass substance per volume tissue water by c. Thus C_z, c_z (mass per gm. ciliary body or ml. ciliary body water).

Permeability constants of membranes by K. Thus: K_{cd} (permeability constant of corneal epithelium in direction stroma to tears).

These permeability constants are defined by the equation:

$$dm_{cd}/dt = K_{cd}\, C_c - K_{dc}\, C_d\, A_{cd}$$

where t is the time.

Transfer coefficients between tissues or fluids by k. Thus: k_{hv} (transfer coefficient from posterior chamber to vitreous). They are defined by the equation:

$$dC_h/dt = k_{vh}\, C_v - k_{hv}\, C_h$$

Since the value of the coefficient depends on the volume of the tissue or fluid in which the concentration changes are being considered, this can be shown where there is a possibility of ambiguity by a further subscript, thus: $k_{h.vh}$ in the equation above. Then $k_{v.\,vh} = V_h/V_v\, k_{h.\,vhv}$

When the transfer coefficient from a tissue or fluid into several others is to be identified, addition signs may be used. For example, the transfer coefficient from the posterior chamber into the vitreous and lens may be written $k_{h.h}\ (v + 1)$.

The total transfer coefficient out of a tissue or fluid may be written simply, thus: k_h.

In the case of the aqueous humor, k_o, k_d and k_f may be retained for the total transfer coefficient out, and its diffusional and flow components.

The steady-state concentration ratio between two tissues or fluid, R. Thus: R_{ap} (ratio of concentration in aqueous humor to that in plasma).

This system can be extended to other branches of ophthalmologic research where it is necessary to give symbols to the properties of the tissue or to the relationships between them.

Stewart Duke-Elder,
David M. Maurice,
Institute of Ophthalmology,
University of London.

BOOK REVIEWS

MODERN PROBLEMS IN OPHTHALMOLOGY. Edited by E. B. Streiff and I. Babel (volume I, Bibliotheca Ophthalmologica, fasc. 47). Basel and New York, S. Karger, 1957. 740 pages, 11 plates, four of which are in color, no index. Price: 60 Swiss francs.

This volume is dedicated to Adolphe Franceschetti on the occasion of his 60th birthday. It is a fine tribute to a fine ophthalmologist who is a close friend to many of us and a familiar figure to all of us in ophthalmology. The preface in French, German, and English consists of suitable laudatory remarks to this "head of a family" as the editors call him, and we join in this well-earned praise. We are hardly surprised to learn that his contributions to ophthalmology consist of 290 titles of published works, as well as innumerable communications and discussions before the major ophthalmologic societies of the world. All praise to this great man.

There are 77 contributions from throughout the world, consisting of such eminent names as Duke-Elder, Amsler, Nordmann, Goldmann, Böck, Busacca, Malbran, François, Bietti, Weekers, Arruga, Paufique, the late Gabriel Sourdille, Waardenburg, Sorsby, van Bogaert, Rintelen, Lindner, Weve, Dekking, Bailliart, Mawas, and many others. The North Americans who are contributors are Schepens, Wald, Berens, Thygeson,

Alan C. Woods, Burian, and Castroviejo.

The subjects covered are ultra structures, cornea, aqueous humor, capillary circulation, lens and vitreous, glaucoma, gonioscopy, vascularization of the optic tract, physiology of vision, electrophysiology, bacteriology, virology, allergy, collagen diseases, myopia, strabismus, nystagmus, retinal detachment, keratoplasty, gerontology, genetics, pain casuistics, psychosomatics, and divers subjects. The papers are written in French, German, or English as the author may choose and emphasize the international character of the work.

It is impossible to review or abstract the contents of this excellent work. Suffice it to say that every student of ophthalmology should possess a copy.

Derrick Vail.

TRAINING AND EMPLOYMENT OF DEAF-BLIND ADULTS. (A symposium.) New York, American Foundation for the Blind, 1956. Paper-bound, 32 pages. Price: 45 cents.

A decade has elapsed since the American Foundation for the Blind inaugurated special services for the deaf-blind. The objective is to prepare the deaf-blind for competitive employment. If this proves unattainable, work-shop placement is considered. If neither is possible, industrial homework must be the choice. The demonstration of a given operation is more important than oral instruction, and both the blind and the deaf-blind must use their fingers to follow the demonstration. An aluminum card, carrying both the regular and braille alphabets, provides a simple means of communication. The sighted person need but grasp the index finger of the blind individual to spell out a message.

James E. Lebensohn.

ELECTRORETINOGRAPHY. (Hamburg Symposium, 1956.) Bibliotheca Ophthalmologica No. 48. Basel, S. Karger, 1957. 203 pages, 104 illustrations. Paper-bound. Price: 27 Swiss francs.

The 19 papers in this symposium cover various phases of electroretinography. The contributors are from Belgium (François, de Rouck, Verriest), Czechoslovakia (Vaný-sek), England (Tansley, Brindley), Germany (Best, Bohnen, Dodt, Heck, Papst, Schmöger, Straub), Holland (Henkes), Italy (Chistoni, Quaranta, Wirth), Sweden (Granit, Karpe, Rendahl, Wadensten), Switzerland (Dieterle, Franceschetti, Monnier). Probably because of the place of meeting the predominant number of papers are in German (14), three are in English, and two in French. The detailed experimental and clinical studies will particularly interest investigators in this field.

James E. Lebensohn.

THERAPEUTIQUE MEDICALE OCULAIRE. Edited by Jean Sedan, Gaetan Jayle, Jorge Malbran, Jules François, and Giorgio Calamandrei. Paris, Masson et Cie, 1957. In two volumes; 1,646 pages, index of authors and subjects at end of volume 2. Price: Not listed.

The approach of various national groups to medical problems has been the basis of more than one good story and, as with most humor, there is always a touch of truth beneath the laughter. The French seemingly have always had a penchant for therapeutics, and one is occasionally amazed at some of the things they have thought of injecting subconjunctivally or retrobulbarly. This interest led to the publication of an annual volume on ophthalmic therapy and has now culminated in the two-volume text here reviewed. This is truly an international presentation, however, because there are over 160 contributors from all the continents except Australia.

The two volumes consist of six parts:

Part I is an alphabetical listing and description of drugs used in ophthalmology. It most resembles a combination of the *Merck*

Index and *The Physicians Desk Reference*. About 250 drugs are listed, and the important ones, such as acetylcholine, are discussed in detail. (One is a little mystified by the injunction given under DOCA [desoxycorticosterone] "see Hyaluronidase").

Part II might be called the *Materia Medica* section. There are 30 chapters dealing with miotics, mydriatics, vasodilators and constrictors, antibiotics, and so forth, and even such esoteric topics as hibernation and sleep-therapy, autohemotherapy, and tissue therapy. The latter is well presented, and the author concludes that the proposed mechanisms for histotherapy are not convincing and that it is difficult to state the indications for such treatment.

Part III deals with physical agents such as X rays, B-radiation, ultrasonics, and so forth. The final chapter in this section deals with "thermalism and climatism" and is replete with the names of romantic sounding places in Europe where the "waters" are apparently beneficial in certain eye diseases. For example Amélie-les-Bains in France, and Baden, Austria, are good for dermatoses while Aix-les-Bains, France, Bath, England, and Baden, Switzerland, are good for iridocyclitis. Unhappily there appear to be no beneficial watering-places in the Western Hemisphere.

Part IV is a comprehensive therapeutic review of diseases of the eye. It is divided into four sections: diseases of the orbit and adnexa, external diseases of the globe, internal diseases of the globe, and refraction. This section is 700 pages long and is actually a book within a book. In its completeness and excellence of organization it brings to mind Fuchs' long out of print *Textbook of Ophthalmology*.

Part V discusses the therapy of systemic diseases with ocular manifestations, and Part VI is entitled ocular hygiene.

In a work of this length and catholicity there is a certain amount of unavoidable repetitiveness which is augmented by the diverse backgrounds of the many contributors. However, since pedagogy is a form of communication, redundancy has a value in reinforcing the message. This book is highly recommended to the Francophilic ophthalmologist. Others should avail themselves of the English translation when it appears.

David Shoch.

THE FAMILY IN PSYCHOTHERAPY. By C. F. Midelfort, M.D. (Adolph Gundersen Medical Foundation, LaCrosse, Wisconsin.) New York, Toronto, London, The Blakiston Division, McGraw-Hill Book Company, 1957. 203 pages. Price: $6.50.

In this book Dr. Midelfort presents case material and theory having to do with his work in what he calls "family therapy." This consists of the use of direct psychotherapeutic techniques not simply with the mentally ill patient but with the patient plus members of his family. The setting for this has been principally the LaCrosse Lutheran Hospital, a general hospital serving this rural Wisconsin community of Scandinavians and Germans among whom Dr. Midelfort feels at home.

The case material includes patients with all major forms of mental illness, including some whose degree of illness is relatively severe when we consider that all this takes place on an ordinary open hospital floor. What appears to be original in his technique is the fact that he goes beyond the average psychiatrist's concern with the family of the patient: most of us are aware of the importance of a patient's family, and work with them or take them into consideration as the occasion demands—this often means referring them to other therapists or ancillary professionals.

Dr. Midelfort goes a step or two further, bringing the family right into the hospital room (and sometimes into the bed), conducting what is essentially group therapy with such members of the family as may be interested, compatible, or co-operative. Thus he encourages the patient and his family to talk

freely before each other; to discuss their attitudes about the illness and all the problems it entails for the family as a whole; to reveal grievances and sorrows, dreams and delusions (to which he evidently makes direct and deep interpretations); and to carry into action (he leaves us guessing as to extent) the physical manifestation of love which he considers essential to healthy and fulfilling relations between people.

One could discuss at length the defects of this book. Short as it is, it is jam-packed with faults of every description. The style is weak and loose, suggesting not only a basic difficulty of verbal self-expression (so severe that we sometimes wonder if English is Dr. Midelfort's native language), but more importantly suggesting also that he does not have his material under control. It is beset with all the jargon and pretentious phraseology of "psychiatric-scientific" verbiage at its worst. It is uneven, since he sometimes brings us up sharp with sparkling clear insights only to relapse into his accustomed ramble. Theory is poorly worked out—many of his ideas are naive and some downright bizarre. He makes no effort, here at any rate, to evaluate his work in relation to other endeavors along the same or similar lines. He fails to give us clear differentiation or critique as to his results: where his procedures are useful and where they have failed, and why—there is a smattering of this but not enough. His techniques themselves are sometimes startling: he evidently does not hesitate to "give body contact" himself if he feels that the therapeutic situation warrants it.

But with all the defects, this is a genuine contribution. The central idea, the application of direct psychotherapeutic techniques to the family as an integral unit, is not only interesting but significant and promising. If his methods seem a little odd, he is at least open about them, and manifestly courageous. If he is uncritical as to results, he is at least honest in presenting failures as well as successes. If his style is prolific and sometimes ridiculous, there is an underlying quality of freshness and simplicity which holds our attention. In short, he is humble and sincere, and although he says it badly, he nevertheless has something to say—for this we should be grateful.

The possibilities of such a therapeutic approach for psychiatry are enormous. For the general physician, too, there is a message to heed: that illness is not only a problem of the whole person but of the whole family. The old-line practitioners have always been intuitively aware of this, but it is good to be reminded, and interesting to speculate on the potential value of the deliberate, controlled, and disciplined use of such a concept.

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ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Redslob, E. **The lamina cribrosa.** Ann. d'ocul. **189**:749-759, Sept., 1956.

The author describes the anatomy of the lamina cribrosa and then presents an illustrated discussion of its embryology. The salient points of his discussion are: normally the lamina is curved posteriorly even in the absence of increased intraocular pressure; the lamina begins to form in the fourth month from neuroglial fibers and in the fifth month mesodermal elements grow in and unite with the neuroglial fibers; in the seventh month elastic fibers begin to appear. It is clear that the lamina is actually formed of three elements. Vascularization is from the short posterior ciliary arteries, the scleral vessels and a few from the choroid. In the embryo fine capillaries from the central artery of the optic nerve traverse the cribriform plate. (9 figures, 6 references) David Shoch.

Wolter, J. Reimer. **Innervation of the corneal endothelium of the eye of the rabbit.** A.M.A. Arch. Ophth. **58**:246-251, Aug., 1957.

The author says that there are no histologic reports in the literature indicating the existence of nerves and nerve endings in the corneal endothelium. In this paper, however, the finding and photomicrographic recording of nerves in the corneal endothelium are reported. (7 figures, 18 references) G. S. Tyner.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Ashton, N., Graymore, C. and Pedler, C. **Studies on developing retinal vessels. V. Mechanism of vaso-obliteration. (A preliminary report)** Brit. J. Ophth. **41**:449-460, Aug., 1957.

Sodium fluoride and sodium iodoacetate, known glycolytic inhibitors, were injected into the vitreous of living kittens and a total obliteration of the premature retinal vessels was produced similar to that induced by oxygen. This effect was not noted in the adult cat eye. Experimental work is in process to test the theory that the mechanism of obliteration is similar to that of oxygen. (3 figures, 2 tables, 24 references) Lawrence L. Garner.

Caronia, G. **Filterable viruses and exanthematous diseases.** Boll. d'ocul. 35:593-600, Sept.-Dec., 1956.

The author discusses the contemporary concepts concerning filterable viruses and acute exanthemata. He emphasizes the necessity of a systemic immunity as prophylaxis in all exanthematous diseases, particularly poliomyelitis and smallpox. (2 figures) William C. Caccamise.

Halbert, S. P., Kazar, C. S. and Swick, L. S. **Mixed bacterial infections in relation to antibiotic activities.** A.M.A. Arch. Ophth. 57:716-723, May, 1957.

The ocular flora contains antibiotic-producing strains of bacteria. Their role in the immunity to superficial infections is uncertain. The authors were able to show that antibiotic-producing staphylococci can protect against death from diphtheria in guinea pigs. (6 tables, 26 references) G. S. Tyner.

Kovalev, D. **Hyaluronic acid and hyaluronidase in the pathology of the visual organ.** Vestnik oftal. 3:40-44, May-June, 1957.

The aqueous of glaucomatous eyes accelerates the sedimentation rate to a higher degree than the aqueous of non-glaucomatous eyes. This probably depends upon the increase of the state of polymerization of hyaluronic acid or its concentration in the fluids of the eye. These changes of hyaluronic acid in the aqueous and in the vitreous could cause hydrophilism of the colloids of the eye and an increase of the intraocular pressure. This supposition is confirmed by the interrelation between the ability of the aqueous of the glaucomatous eye to accelerate the sedimentation rate and the intraocular pressure. The changes of the hyaluronic acid in fluids of the eye indirectly confirm the data of the various actions of hyaluronidase in the iris and ciliary body in glaucoma and other diseases of the eye. (2 drawings, 2 tables) Olga Sitchevska.

Remky, H., Kuechle, H. J. and Vollbrechtshausen, R. **Quantitative serologic examinations in suspected toxoplasmosis of the eye.** Klin. Monatsbl. f. Augenh. 130:794-800, 1957.

These examinations were done on three patients. The antibody titer was determined in the serum and in the aqueous. The quotient of these two values was calculated. (1 figure, 7 tables, 2 references) Frederick C. Blodi.

Ullerich, K., Wulf, K. and Wiskemann, A. **Ocular affections due to light sensitization by a photodynamic substance.** Klin. Monatsbl. f. Augenh. 131:30-48, 1957.

A 42-year-old man developed a severe keratoconjunctivitis while being treated with antituberculous drugs and with Megaphen, a chlorpromazine-like compound. It became evident that the severe inflammation was caused by a sensitization to light and it could be shown that the noxious rays were the long ultraviolet and the short waves of the visible spectrum. Skin tests revealed the probability of a photo-allergic reaction to Megaphen. The patient remained symptomless when he wore his filtering glasses. (7 figures, 13 references) Frederick C. Blodi.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Ambrosio, Andrea. **Alkaline reserve of ocular fluids in retinal degeneration.** Gior. ital. oftal. 9:636-643, Nov.-Dec., 1956.

The alkaline reserve in ocular fluids diminished during the inflammatory stage of retinal degeneration which was produced in rabbits by intravenous injections of sodium iodate. (2 tables, 41 references) V. Tabone.

Andreani, D. and Volpi, U. **Effect of Adaptinol on light sensitivity in normal eyes and in eyes with retinitis pigmentosa.** Gior. ital. oftal. 9:465-573, Sept.-Oct., 1956.

Experiments on ten normal subjects and on eight with retinitis pigmentosa showed that administration of Adaptinol by mouth in daily doses of 15 mg. for ten days increased the light sensitivity and lowered the light threshold. These changes were noted after the first few days and increased progressively to the end of the second month when they became progressively less. The drug is a carotene derivative and may act as a provitamin A, thus taking part in the synthesis of visual purple. (3 graphs, 24 references)

V. Tabone.

Baumann, H. **Can a longlasting and intensive chlorpromazine administration damage the eye?** Klin. Monatsbl. f. Augenh. 130:769-793, 1957.

The author examined 35 schizophrenic patients (31 to 65 years old) who had been given a total of 25 to 248 gm. chlorpromazine over a period of 6 to 30 months. Only in two patients was the dark adaptation curve not quite normal. A toxic damage of the retina could be practically excluded. The use of chlorpromazine in ophthalmology is discussed. It is of some use in increasing the effect of sedatives and narcotics. (5 figures, 61 references) Frederick C. Blodi.

Berger, G. P., Fadiga, E. and Pupilli, G. C. **Analysis of the electrical cerebellar responses on stimulation of the visual pathways of the cat.** Bull. et mém. Soc. franç. d'opht. 69:160-167, 1956.

The reaction of the cerebellar cortex of the normal cat to visual stimuli was investigated. Electrical and photic stimuli evoked a discernible response of the vermis cerebelli and could be recorded by an oscillograph. The stimulated region approached the area responsive to auditive stimuli and, as in tactile and proprioceptive projection was in contact with corresponding sensory areas of the cerebral cortex. The vermis cerebelli sustained by the formatio reticularis has an important regulating function in regard to the postural tonus in man as well as in other vertebrates. The optical projection may be an equally regulating factor in the postural tonus of regard (vestibular subdivision of the paleocerebellum) as well as in the postural tonus of the trunk (spinal subdivision). A reflex mechanism may be responsible and also promote regulation of more or less direct connections with the organ of response, the muscles. The methods of examination and the results are discussed. The importance of photic messages to the cortex and the effect of these messages in adaptation of the individual to the outside world are explained and discussed. (3 figures, 10 references) Alice R. Deutsch.

Bettman, J. W. and Fellows, V. G. **Factors influencing the blood volume of the choroid and retina.** Tr. Am. Acad. Ophth. 60:791-805, Nov.-Dec., 1956.

The authors describe certain drugs used in their studies with their own procedure. They found that carbon dioxide is one of the best vasodilators. When given in a concentration of 8 to 10 percent in air it produced a marked and consistent effect. This effect was the same whether given with air or pure oxygen. This may be of clinical value in occlusion of the central artery. Oxygen does not constrict adult vessels or diminish the effect of carbon dioxide. It may be advantageous to administer a combination of these gases in order to attain the vasodilator effect of carbon dioxide while giving oxygen to support the anoxic retina. Their experiments show that nitrites have very little effect when given systemically. Priscoline

and aminophylline have a great effect when given by retrobulbar injection, but none when used systemically. Mecholyl and epinephrine seem to act mainly systemically, even if used locally, and they have an effect opposite to the generally accepted one. Hexamethonium and nicotine have little or no peripheral action.

The authors suggest that the following may be applied to man: carbon dioxide systemically, priscoline 12.5 mg. and aminophylline 25 mg./1cc. by retrobulbar injection or paracentesis and cold to extremities. They are safe and effective in increasing the intraocular blood volume. Carbon dioxide is safely given by rebreathing, preferably through a long tube concurrently with oxygen. (23 figures, 22 references) Theodore M. Shapira.

van Beuningen, E. G. A. and Fischer, F. W. **The clinical determination of pulse volume and basic blood flow to the eye.** Klin. Monatsbl. f. Augenh. **131**:57-61, 1957.

An electric tonometer is used and the pressure changes are transposed into volume changes using the nomogram of Friedenwald. To determine the total blood flow to the eye the arterial flow is temporarily interrupted with an ophthalmodynamometer. The latter is suddenly withdrawn and the first pulse curve registered by the tonometer is used. This inflow was calculated to be 15 to 20 cmm. The pulse volume was found to be 2 cmm. (4 figures, 10 references)

Frederick C. Blodi.

Bonavolonta, A. **Corneal lipoids in normal and pathologic conditions.** Bull. d'ocul. **35**:727-768, Sept.-Dec., 1956.

The author studied the lipoid content of the cornea in normal and pathologic conditions. He employed both histochemical stains and analytical techniques. There was a decided difference in the lipoid contents in normal and pathologic conditions. Analytical methods were more sensitive in revealing this difference. The author concludes that an increase in the lipoid content of the cornea is an indication of a degenerative condition. (28 figures, 123 references)

William C. Caccamise.

Breinin, Goodwin M. **Quantitation of extraocular muscle innervation.** A.M.A. Arch. Ophth. **57**:644-650, May, 1957.

The author illustrates the practical value of electromyography in the study of ocular neuromuscular physiology. In his hands, and in institutions properly equipped, it is a simple and valuable tool for the study of innervational aspects of various positions of gaze, ocular muscle actions, and the effect of drugs upon the ocular muscles. (8 figures, 3 references)

G. S. Tyner.

Carmichael, P. L., Hamblin, C., Green, H. and Leopold, I. H. **Evaluation of histochemical techniques for carbonic anhydrase in ocular tissues.** A.M.A. Arch. Ophth. **58**:169-173, Aug., 1957.

This paper outlines attempts to demonstrate the presence and location of the carbonic anhydrase in various ocular tissues by histochemical methods. None of the techniques produced constant results or showed inhibition of the enzyme by acetazolamide. (2 figures, 19 references)

G. S. Tyner.

Damiani, A. **Acetylcholine shock and the blood aqueous barrier.** Gior. ital. oftal. **9**:665-670, Nov.-Dec., 1956.

Acetylcholine shock lowered the blood aqueous barrier. (31 references)

V. Tabone.

Damiani, A. **Effect of cytotoxic serum on experimentally produced corneal vascularization.** Gior. ital. oftal. **9**:659-664, Nov.-Dec., 1956.

Cytotoxic serum of Bogomoletz given by subconjunctival injection increased the

corneal vascular reaction. New-formed vessels as well as corneal infiltration appeared earlier and was more marked, but both vascularization and opacification cleared more quickly after cessation of the stimulus. (15 references, 2 figures)

V. Tabone.

Damiani, A. **Influence of the aqueous on blood clotting.** Gior. ital. oftal. 9:560-564, Sept.-Oct., 1956.

The well-known property of the aqueous of accelerating blood clotting was maintained even when Tromexan was administered. This effect of the aqueous could occur either during the formation of thrombin, or of fibrin from fibrinogen. (1 figure, 5 references) V. Tabone.

Del Buono, G. and Acocella, M. **Lysozyme in relation to various ocular conditions.** Gior. ital. oftal. 9:574-591, Sept.-Oct., 1956.

The authors have found wide differences in the lysozyme content of tears in both normal eyes and in eyes which are the seat of various affections. No definite relation could be established between lysozyme content and ocular disease. (2 graphs, 4 tables, 42 references)

V. Tabone.

D'Esposito, Mario. **The glycogen content of the retina after treatment with ACTH and cortisone.** Arch. di ottal. 61: 129-142, March-April, 1957.

After treating rabbits with 50 mg. cortisone daily for up to 10 days, no fundus changes were seen and eosine-hematoxyline or iron-hematoxyline showed no histologic changes. The Hotchkiss-McManus method showed a small increase of the glycogen content of the retina after 10 days' treatment with 100 mg. cortisone daily and a marked increase after 10 days of 20 I.U. of ACTH daily. (3 photomicrographs, 1 table, 48 references)

John J. Stern.

De Vincentiis, Mario. **Some biochemical observations on the lens with experimental modifications of the protein content of the intraocular fluids.** Arch. di ottal. 61:117-127, March-April, 1957.

The intraocular fluids were modified by keratocentesis or injections of homologous plasma or lysozyme into the vitreous. Slight lens opacities of nonprogressive character were accompanied by no variations of Na, K or the N of amino acids. When complete opacification of the lens was produced, N increased and K and Na decreased. Keratocentesis is followed by an increase of inorganic P in aqueous and lens. (1 table, 25 references)

John J. Stern.

François, J. and Rabaey, M. **On the existence of an embryonic lens protein.** A.M.A. Arch. Ophth. 57:672-680, May, 1957.

The authors describe work which has led to the proof of a third important water soluble lens protein fraction which is apparently an embryonic protein. (19 figures, 5 tables, 16 references)

G. S. Tyner.

François, J., Rabaey, M. and Evens, L. **Microelectrophoresis of the proteins of the human aqueous.** Bull. Soc. belge d'opht. 114:606-613, 1956.

The aqueous examined in this study was taken immediately after death or from the living eye. In the latter case it was always combined with an analysis of the blood serum. The preliminary examinations were not conclusive so far. The aqueous contained more albumen and less gamma globulin than the serum, the concentration of alpha globulin was variable; the concentration of beta globulin was more stable. A pre-albumin was found which was variable in amount. (5 figures, 4 tables, 11 references)

Alice R. Deutsch.

François, J. and Rabaey, M. **New technique in fractional separation of the proteins of the aqueous by microelectrophoresis on gelatine.** Bull. Soc. belge d'opht. **114**:593-604, 1956.

The electrophoresis of the proteins of the normal aqueous always has been found extremely difficult because of the low concentration of proteins and the relatively high concentration of salts. A new method of concentration and a new method of microelectrophoresis is described in detail. With this method an analysis of the proteins was possible even with a very small amount of aqueous (25 to 80 microliters). Routine anterior chamber puncture now gives enough material for microelectrophoresis and pathologic cell investigations. (6 figures, 3 tables, 8 references) Alice R. Deutsch.

Frezzotti, R. and Scagnetti, A. **Protein fractions in human cataracts.** Gior. ital. oftal. **9**:629-635, Nov.-Dec., 1956.

Examination by the method of paper electrophoresis, using a buffer of pH 6.6, revealed the presence of two protein fractions in 28 human cataractous lenses. (26 references) V. Tabone.

Grant, W. Morton. **Ophthalmic pharmacology and toxicology.** A.M.A. Arch. Ophth. **58**:265-284, Aug., 1957.

This excellent review covers the relevant literature published during the period April, 1956, to April, 1957. (147 references) G. S. Tyner.

Lucas, D. R. and Newhouse, J. P. **The toxic effect of sodium L-glutamate on the inner layers of the retina.** A.M.A. Arch. Ophth. **58**:193-201, Aug., 1957.

Glutamic acid and derivatives have been used in the oral treatment of petit mal and mental deficiency. However, the authors have observed that the parenteral administration of sodium L-glutamate damaged the inner layers of the retina. When given by injection, typical changes appear in the ganglion cells and inner nuclear layer of the mouse retina within thirty minutes. (12 figures, 3 tables, 22 references) G. S. Tyner.

Marsico, Vincenzo. **Clinical and experimental observations on the relationship between sedimentation rate and ocular wounds.** Arch. di ottal. **61**:151-162, March-April, 1957.

In five rabbits and 94 patients with ocular injuries ranging from superficial abrasions to severe contusions and serious perforating wounds, acceleration of the blood sedimentation rate was proportional to the severity of the injury. (3 tables, 15 references) John J. Stern.

McDonald, James E. **Early components of corneal wound closure.** A.M.A. Arch. Ophth. **58**:202-216, Aug., 1957.

Observations of early closure of the wound in rabbits, cats, dogs, monkeys, and man is reported. The author reports an immediate retraction of Descemet's membrane and posterior layers of the cut stroma, which produces a large inverted V-shaped gaping of the incision posteriorly. Formation of a fibrin plug is rapid, but edema of the corneal stroma develops very slowly. (11 figures, 18 references) G. S. Tyner.

Newell, F. W., Beaman, T. C., Jacobson, L. O., Marks, E. K. and Caston, E. O. **The effect of cell suspensions upon the development of cataracts in irradiated mice.** A.M.A. Arch. Ophth. **57**:846-848, June, 1957.

The postirradiational administration of various cell suspensions that have been found to be effective in prolonging the lives of lethally irradiated mice does not protect the animals against the development of cataract. (3 tables, 5 references) G. S. Tyner.

Paliaga, Paolo. **Hydroxyltryptamine in ophthalmology.** Gior. ital. oftal. **9**:617-627, Sept.-Oct., 1956.

Hydroxyltryptamine was experimentally used by local application and by intravenous and intramuscular injection. It was found useful to control conjunctival hemorrhages but not those arising from corneoscleral sections, or those occurring inside the eye. Used by the intravenous route it was found useful in operations on the lids and the lachrymal sac but not in hemorrhagtic retinopathies. (14 references) V. Tabone.

Perkins, E. S. and Gloster, J. **Further studies on the distensibility of the eye.** Brit. J. Ophth. **41**:475-486, Aug., 1957.

Two methods are described for determining the ocular rigidity in rabbit eyes. In one a canula is introduced into the anterior chamber of the living eye through the cornea and in the other the canula enters an enucleated eye through the optic nerve. The coefficient of ocular rigidity seemed the same or almost the same after either method. At lower intraocular pressure the coefficient of ocular rigidity presented greater variation than at higher pressures. (8 figures, 3 tables, 9 references) Lawrence L. Garner.

Scassellati Sforzolinie, Guidobaldo. **Salicylate of sodium in experimental ophthalmology.** Rassegna ital. d'ottal. **26**:19-37, Jan.-Feb., 1957.

The action of sodium salicylate in various classical examples of experimental ocular process in laboratory animals was studied. The results were compared with those of cortisone. The salicylate was given in 5-percent solution administered in heavy doses hypodermically so that it might be absorbed intraocularly. In the uveitis of the horse the effect was almost as great as that of cortisone. When introduced into the anterior chamber cortisone was less effective than sodium salicylate and frequently produced irritative phenomena. The sensitivity to calicylate is not equal in all animals, nor does sodium salicylate modify the titer of the specific precipitins. The author discusses the antiphlogistic action of sodium salicylate. (17 figures, 36 references)

Eugene M. Blake.

Seitz, R. **The age factor in pupillary dilatation with dark adaptation.** Klin. Monatsbl. f. Augenh. **131**:48-56, 1957.

The pupillary diameter was measured with the pupillometer of Haab and photographically with the iridoscope of Zeiss; 26 patients were examined. The mydriasis in darkness decreases with age. The pupil dilates to a diameter of more than 7 mm. before the age of twenty, to a diameter of less than 5 mm. after the age of 70. This dilatation did not depend on the color of the iris, nor on the sex of the patient. The patients remained in the dark room for an hour, but dilatation can be noticed already after 1 second and reaches nearly maximal values after 1 minute in the dark room. (7 figures, 1 table, 13 references.)

Frederick C. Blodi.

Stagni, S. **The effect of ASC 16 (Calcium Sandoz and Sandosten) on allergic diseases of the eye.** Gior. ital. oftal. **9**:602-611, Sept.-Oct., 1956.

Twenty cases of serious allergic ocular disturbance were treated by local applications (which included cortisone) and by a daily intravenous injection of ASC 16. In a very short time 16 patients were well and the other four improved greatly. Four relapses were treated similarly and the patients were well in a shorter time. (2 tables, 24 references) V. Tabone.

Swanson, A. A., Rose, H. W. and Taube, J. I. **Glutathione protection in X-irradiated eyes.** A.M.A. Arch. Ophth. **57**: 832-839, June, 1957.

A preliminary investigation was made

on the changes in rabbit eyes after X-radiation alone and after previous treatment with glutathione. The experiments indicate that pretreatment with glutathione is definitely protective for 800 r radiation. Also protection was found against ionizing radiation with glutathione in the retina, lens capsule, and iris for succinic dehydrogenase and cytochrome oxidase activity. (9 figures (8 in color), 4 tables, 13 references) G. S. Tyner.

Weale, R. A. **Observations on photochemical reactions in living eyes.** Brit. J. Ophth. **41**:461-474, Aug., 1957.

Information as to the nature of pigment behaviour after exposure to light is obtained from the living frog and cat eye. After being light adapted, the ratio of light entering the eye to that leaving the eye would seem to suggest that in the light adapted eye, an accumulation of light-sensitive substance must occur in the retina. (8 figures, 1 table, 20 references) Lawrence L. Garner.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Eggers, Harry. **Variations of the fundus reflex in ametropia.** A.M.A. Arch. Ophth. **57**:801-814, June, 1957.

When one views the fundus reflex with the ophthalmoscope, one portion of the pupillary area usually is much brighter than the remainder, and the boundary between these two areas is a curved one with the concavity upward. The position and extent of these two areas, the brighter area and the darker area, vary with the refractive state of the eye. This phenomenon is caused by the fact that in the ophthalmoscope the sight hole is displaced upward relative to the axis of illumination. (5 figures, 3 tables, 1 reference) G. S. Tyner.

Goodman, G. and Bornschein, H. **Comparative electroretinographic studies in congenital night blindness and total color blindness.** A.M.A. Arch. Ophth. **58**:174-182, Aug., 1957.

The authors report their quantitative investigations of dark adaptation and stimulus intensity on the electroretinogram of one congenitally night-blind, one totally color-blind, and three normal subjects using single flash stimuli. They report that the negative and positive waves (a-waves and b-waves) of the totally color-blind subject reflected exclusively scotopic activity, and the positive wave (x-wave) of the congenitally night-blind subject reflected photopic activity. (7 figures, 26 references) G. S. Tyner.

Grandperret, R. and Roux, M. **A new concept of correcting lenses. ("Exact" lenses and "corrected curve" lenses.)** Ann. d'ocul. **189**:712-718, Aug., 1956.

The authors define an "exact" lens as one which gives the best possible image independent of its effect on the eye. They use the term "rationnel" or "corrected-curve" to describe a lens which is effective in all directions of gaze and which gives an image which is perfect with respect to the eye. The latter is familiar to most ophthalmologists as the "Tillyer" lens while the former is the "Tscherning-Ostwalt" type. Slight variations in the corrected-curve lenses can be made for the particular distance at which they are to be used. (2 figures) David Shoch.

Junès, Emile. **Stereoscopic luster.** Ann. d'ocul. **189**:681-698, Aug., 1956.

Stereoscopic luster is a purely experimental phenomenon that results when one attempts to fuse a white object and a black object of similar size and shape with the stereoscope. The resulting image appears gray and has a peculiar luster. The author feels that this luster is differ-

ent from that seen in nature on metallic objects or polished surfaces. In the latter cases the luster is inherent in the object seen, while in stereoscopic luster the phenomenon is a retinal one. It is apparently due to a rapidly alternating appreciation of the two luminances involved and would thus fall into the category of phenomena caused by retinal rivalry. (3 figures)

David Shoch.

Linksz, Arthur. **Optics and visual physiology.** A.M.A. Arch. Ophth. **57**:869-927, June, 1957.

Every ophthalmologist should take the time to peruse this remarkably complete and readable review. (178 references)

G. S. Tyner.

Marin-Amat, M. **The mechanism of the transformation of corneal astigmatism with the rule into astigmatism against the rule, in the course of time.** Arch. Soc. oftal. hispano-am. **17**:145-164, Feb., 1957.

The material for this study comprises 17,881 refraction histories of patients seen in the course of 50 years of practice. Many of these patients were followed for long periods of time, some as long as 40 years. 150 histories of children between three and six years of age show that corneal astigmatism develops during the period of corneal growth, and is just as frequent at the end of the first decade of life as it is in adult life. In this material, astigmatism against the rule was found once at the age of five years and twice at the age of six. The analysis of his material leads the author to conclude that the cornea is but rarely astigmatic at birth, and as a rule may be considered as spherical. During the first ten years of life the cornea, spherical at birth, develops an astigmatism with the rule in 92.47 percent of cases. In the further course of development the meridian of greatest curvature flattens, and at some period the cornea again becomes spherical; as the flattening process continues there develops an astigmatism against the rule, which is the last stage in the development of the corneal curvature. The factors responsible for these physiologic changes in the corneal curvature are the pressure of the eyelids and of the extraocular muscles, the action of the ciliary muscle, possibly changes in corneal elasticity, and the growth of the cornea itself and of the eyeball. The mechanism of action of these factors is discussed in detail. (2 tables; 9 references)

Ray K. Daily.

Nebel, Bernard R. **The phosphene of quick eye motion.** A.M.A. Arch. Ophth. **58**:235-243, Aug., 1957.

The flick phosphene is ascribed to an instantaneous and transient deformation of the posterior surface of the vitreous emanating in a particular "polarized" pattern from its attachment at the optic disc. The deformation caused by an inertial-lag is postulated to be transmitted to the retina. (2 figures, 13 references)

G. S. Tyner.

Ogle, K. N. and Martens, T. G. **On the accommodative convergence and the proximal convergence.** A.M.A. Arch Ophth. **57**:702-715, May, 1957.

From this study the authors conclude that myopes have a higher (A-C)/A ratio than hyperopes and convergence excess is associated wtih an increased (A-C)/A ratio but not with an increased proximal convergence. (7 figures, 3 tables, 14 references)

G. S. Tyner.

Ourgard, A. G. **Temporal spatial discrimination as a new method to measure visual acuity.** Bull et mém. Soc. franç. d'opht. **69**:151-159, 1956.

This is only a preliminary report on a new and ingenious method of testing visual acuity. The equipment consist of a transparent screen and two projectors which throw the image of a chequer board

on the screen. The images are immaculately focused so that the black square of one checkerboard coincides with the white square of the other. The diameter of the checkerboard equals 5cm. The diameter of the squares equals 4mm. A timed electrical device moves a blade-shaped blind in front of the projectors, covering and uncovering the images in rapid succession. The illumination of the board as measured with the nitromètre of Jobin and Yvon amounts to 300 units. The number of cycles was fixed at 8 to 10 per second. The distance between the test object and the patient is the variable element and changes from 3 to 12 m as needed. The patient approaches the screen slowly, giving information on his visual perceptions.

The findings on five patients are summarized in tabular form. The successive stages of the examination are described and explained. (2 tables, 10 references,)

Alice R. Deutsch.

Swan, K. C. and Wahlgren, R. E. **Anaglyphic phenomena in anomalous correspondence.** A.M.A. Arch. Ophth. **57**: 842-845, June, 1957.

When some strabismus patients are wearing anaglyphic glasses, they observe part of a white screen to appear red and other parts green. These phenomena are elicited best when the patient looks at a brightly lighted unmarked screen while wearing red and green filters. They are best explained on the basis of predominance of the macular region of each eye over the abnormally corresponding peripheral retinal areas in the other eye when dissimilar stimuli of equal intensity are presented in these regions. (3 figures, 3 tables, 5 references) G. S. Tyner.

5

DIAGNOSIS AND THERAPY

Aguilar Bartolome, Jose M. **The use of methyl celluluose in ophthalmology.** Arch. Soc. oftal. hispano-am. **17**:203-214, Feb., 1957.

The physicochemical properties of the viscosity, the effect on the superficial tension of ocular tissues, the stability, the tolerance, and the optic properties of methyl cellulose are described in detail. It is concluded that methyl cellulose is more suitable than the natural resins to provide the desirable viscosity for liquid vehicles used in ophthalmology. It is not irritating to the ocular tissues, it reduces their superficial tension, it does not interfere with the pharmacologic action of therapeutic agents, it does not precipitate in the lacrimal passages and does not cause sensitization. Its lubricating quality is soothing in conjunctivitis. It is particularly useful in conjunctivitis sicca, in the application of contact lenses and of prisms in gonioscopy, and in facilitating movement of the lids over ocular prosthesis. The most suitable concentration for collyria is 0.33 percent of the 4,000 cps. For conjunctivitis sicca as well as contact lenses and gonioscopy 0.50 percent, and for ocular prosthesis 0.75 percent should be used. (4 tables, 8 references) Ray K. Daily.

Barraquer Moner, Jose I. **Subconjunctival suture in cataract operation.** A.M.A. Arch. Ophth. **57**:815-820, June, 1957.

Moner gives his technique of placing subconjunctival silk sutures in cataract surgery, and claims that it not only adds to the safety but also to the comfort of the patient. (5 figures, 1 table, 3 references) G. S. Tyner.

Burian, H. M., Rice, M. H. and Allen, L. **External visibility of the region of Schlemm's canal.** A.M.A. Arch. Ophth. **57**:651-658, May, 1957.

The authors report on two patients in whom they were able to observe Schlemm's canal by external slitlamp

examination. Both patients were of a family who had varying degrees of mesodermal dysgenesis of the cornea and iris. Anatomic conditions existed whereby the external limbus did not extend as far toward the cornea as is usual. (7 figures, 2 tables, 5 references) G. S. Tyner.

Donn, A. and McTigue, J. W. **The radioactive phosphorus uptake test for malignant melanoma of the eye.** A.M.A. Arch. Ophth. **57**:668-671, May, 1957.

The P^{32} uptake test was studied in 40 cases of suspected intraocular malignant melanoma. The authors considered its greatest usefulness in providing objective confirmation of the diagnosis of suspected malignant tumor. In this series there were no false positives and only one false negative. All of 17 eyes which were enucleated had shown a plus test and all contained a tumor. (14 references) G. S. Tyner.

Gunkel, R. D. and Bornschein, H. **Automatic intensity control in testing dark room adaptation.** A.M.A. Arch. Ophth. **57**:681-686, May, 1957.

The authors describe a modified Goldmann-Weekers instrument which enables a nurse or technician to determine dark adaptation curves clinically. (2 figures, 2 tables, 2 references) G. S. Tyner.

Magilnitsky, S. **Local application of cortisone in ophthalmology.** Vestnik oftal. **4**:27-33, July-Aug., 1957.

Cortisone was used on 100 patients locally since 1955. The therapy was effective in 86, ineffective in 12 and in two patients there was an exacerbation of the process. There was no improvement in primary glaucoma, postoperatively after keratoplasty, in endophthalmitis and in Sjøgren's syndrome. Good results were obtained in diseases of the cornea, in dermatitis of the lids and blepharoconjunctivitis, and in iritis and iridocyclitis. In chemical and thermal burns of the eye cortisone gave favorable results. Cortisone should be used only four to five days after operation on the eyes, since its action can slow down the healing of the wound. Olga Sitchevska.

Manchester, P. Thomas, Jr. **Sponge attachment for epiphora.** A.M.A. Arch. Ophth. **57**:739, May, 1957.

The author suggests attaching a sponge to the nosepiece of spectacles to alleviate epiphora. (3 figures) G. S. Tyner.

O'Rourke, J. F., Patton, H. and Bradley, R. **Fundamental limitations of radiophosphorus counting methods used for detection of intraocular neoplasm.** A.M.A. Arch. Ophth. **57**:730-738, May, 1957.

Studies conducted by the authors suggest that further work and revision is necessary on present dosage and external counting methods. (4 figures, 6 tables, 30 references) G. S. Tyner.

Roberts, Winston. **The multiple-pattern tachystoscopic visual field screener in glaucoma.** A.M.A. Arch. Ophth. **58**:244-245, Aug., 1957.

The multiple-pattern tachystoscopic visual field screening tests were done on 1,500 patients. Tangent screen findings were compared on 107 glaucoma cases, and 33 glaucoma suspects. The author believes the method reliable in case-finding and glaucoma follow-up. (3 tables, 2 references) G. S. Tyner.

Ros Pena, R. and Casado Corzo, J. P. **Variations in the electrophoretic spectrum introduced by technique.** Arch. Soc. oftal. hispano-am. **17**:194-202, Feb., 1957.

The author found, in his investigations of the proteins of the crystalline lens, that slight modifications in technique may produce significant changes in the results obtained with normal as well as with cataractous lenses. The modifications in tech-

nique and the results are described and illustrated. (13 electrophoretic charts)

Ray K. Daily.

Unger, Max. **A new method of measuring interpupillary distance.** A.M.A. Arch. Ophth. **58**:257-258, Aug., 1957.

The devices consist of two circular disks with a centrally placed tubule in each. The discs are of a suitable size to fit into a trial frame. The patient looks at the distant chart, puts his fingers on the screw that moves the lenses in and out, and turns the screw until he sees the chart with each eye and the circles have fused to one. The interpupillary distance is read off the bar. For near, the process is repeated with a Snellen reading chart. (3 figures)

G. S. Tyner.

Zugsmith, George S. **A combination of a magnetic tangent screen with the Harrington multiple-pattern field screener.** A.M.A. Arch. Ophth. **58**:256, Aug., 1957.

The author describes the method and advantages of combining the two instruments in one. (3 references)

G. S. Tyner.

6

OCULAR MOTILITY

François, J. and James, M. **Treatment of concomitant strabismus. Comparative study of late results in different age groups.** Ann. d'ocul. **189**:771-777, Sept., 1956.

The authors re-examined 594 cases of strabismus six years after treatment and divided them into two groups: children below six years of age and children from 6 to 15 years of age at time of treatment. As might be anticipated the best results were obtained in accommodative squints treated with glasses and orthoptics only. These children should begin treatment between the ages of two and four years. Results were slightly less favorable if there was a nonaccommodative element present and the authors feel that here early surgery (before the age of six years) is indicated. In the remaining cases (that is, those with amblyopia and lack of fusion) results are just as good if surgery is postponed until late in life. (5 tables)

David Shoch.

Huysmans, J. **A new surgical technique in strabismus.** Ann. d'ocul. **189**:797-803, Sept., 1956.

The new surgical technique here described consists of placing a nylon suture through a muscle near its insertion and forcibly rotating the eye to the opposite side. This is done after injection of hyaluronidase under the muscle sheath which permits stretching of muscle fibers, according to the author. The nylon suture is fastened to a malleable rod which is fastened to the face with dental plaster. Twelve operations have been done. The author reports three good results, one partial success and "several" failures. (2 figures).

David Shoch.

Priggert, W. **Ocular palsies in herpes zoster ophthalmicus.** Klin. Monatsbl. f. Augenh. **131**:72-77, 1957.

Seven cases are presented. The third nerve is commonly affected. The prognosis is good and the etiology remains obscure. The palsies could be caused by a mild meningitis, by an affection of the nerves directly from the semilunar ganglion or by an accompanying periarteritis nodosa. (20 references)

Frederick C. Blodi.

7

CONJUNCTIVA, CORNEA, SCLERA

Aguilar Bartolome, Jose M. **Corneoscleral dermo-chondrolipoma.** Arch. Soc. oftal. hispano-am. **17**:72-76, Jan., 1957.

The incentive for reporting this case was the finding of cartilagenous tissue in

the section of the excised neoplasm, which is a rare occurrence. The patient, a 12-year-old girl, had the neoplasm since birth. The theories on the pathogenesis of these neoplasms is reviewed. It is suggested that in making the extirpation, the cosmetic result will be better if the conjunctiva is sutured to the limbus, and not permitted to adhere to the raw corneal surface. (4 figures) Ray K. Daily.

Araez Pacheco, Rafael. **The treatment of trachoma.** Arch. Soc. oftal. hispano-am. 17:117-127, Feb., 1957.

This presentation was based on an experience with 18,000 trachoma patients treated in the district of Almeria, Spain, under the Public Service. The therapeutic agents used in trachoma are reviewed and the conclusions emerging from the clinical experience are summarized as follows. Trachoma can be cured by various procedures, sometimes there is even a spontaneous recovery. The trachomatous cicatrices are to be regarded as sequelae of the disease and not its symptoms. There is no specific therapeutic agent for the trachoma organism, which is believed to be a virus. Neither the sulfonamides nor antibiotics can be considered specific. Sulfonamides are excellent auxiliary drugs, to be taken internally, and of the antibiotics the most effective are aureomycin and terramycin used locally. The sulfa drugs and antibiotics are effective in the initial stage of trachoma, but not in advanced trachoma, when patients usually seek medical service. To make the subconjunctival tissue accessible to the medicament it is necessary to resort to the classical mechanical and surgical procedures for removing the trachoma follicles. These procedures, which have been largely abandoned, should be revived.

Ray K. Daily.

Cuccagna, F. and Damiani, A. **Gamma globulins in the treatment of herpetic keratitis.** Gior. ital. oftal. 9:671-683, Nov.-Dec., 1956.

A solution of gamma globulin was used on 11 patients who had herpetic manifestations in the cornea. A single subconjunctival injection was followed by local instillation of the same solution. Good results were obtained and the authors believe this to be due to the action of antibodies contained in the gamma-globulin solution. (1 figure, 49 references)

V. Tabone.

Herm, Robert J. **Severe membranous conjunctivitis with recovery.** A.M.A. Arch. Ophth. 57:740-743, May, 1957.

A case in a 12-year-old white boy is reported. Recovery was effected by the use of Gantrasin, penicillin and bacitracin. (4 figures) G. S. Tyner.

Malhotra, Manmohan. **Congenital pterygium.** Brit. J. Ophth. 41:502-503, Aug., 1957.

A pterygium involving the nasal aspect of one eye and noted at birth is reported as a rare finding after a search of the records. (1 figure, 1 reference)

Lawrence L. Garner.

Martinovskaya, V. **The treatment of ulcers with Biomycin.** Vestnik oftal. 3:26-27, May-June, 1957.

Eight to 10 instillations of Biomycin were given daily; 87 eyes were treated and six had deep corneal ulcers. The bacteriologic examination showed pneumococcus, staphylococcus and streptococcus, which disappeared in three to five days. The deep ulcers cleared up in four to five days. Biomycin is to be recommended for the treatment of corneal ulcers as it shortens the time of treatment and aids the regeneration of the cornea.

Olga Sitchevska.

Ruiz Barranco, F. and Arques Girones, E. **Pemphigus of the conjunctiva.** Arch.

Soc. oftal. hispano-am. 17:128-138, Feb., 1957.

The author describes this ocular disease under the name of retraction conjunctivitis and reports two clinical cases. The differential diagnosis, particularly from trachoma, is discussed in detail and the pathogenesis and treatment briefly reviewed. (6 references) Ray K. Daily.

8

UVEA, SYMPATHETIC DISEASE. AQUEOUS

Becker, Bernard. **Chemical composition of human aqueous humor.** A.M.A. Arch. Ophth. 57:793-800, June, 1957.

The aqueous humor from the anterior chamber of 22 cataractous eyes was analyzed. As compared to plasma of the same patient, there was more acid, an excess of chloride and deficit of bicarbonate. There was a fifteenfold average excess of ascorbate.

Aqueous of the rabbit eye, on the other hand, has a deficit of chloride and an excess of bicarbonate. (6 tables, 18 references) G. S. Tyner.

Cassady, J. V. **Toxoplasmic uveitis.** A.M.A. Arch. Ophth. 58:259-264, Aug., 1957.

This paper is a valuable review of the present tests and treatment for toxoplasmic uveitis. (22 references) G. S. Tyner.

François, J. and Neetens, A. **Spontaneous disappearance of rubeosis of the iris.** Ann. d'ocul. 189:778-789, Sept., 1956.

The authors report three cases of rubeosis of the iris with glaucoma where there was a spontaneous regression of the rubeosis and a parallel diminution in ocular tension. The first patient had a central retinal vein thrombosis and the other two were diabetic. The rise in tension paralleled the amount of new vessel formation in the angle. Pilocarpine was used in all cases and an unsuccessful cyclodiathermy performed in one. The authors feel that the treatments used were unassociated with the recovery. (7 figures, 5 references) David Shoch.

Gaertner, J. **Choroidal involvement in mycosis fungoides.** Klin. Monatsbl. f. Augenh. 131:61-69, 1957.

A 52-year-old man with disseminate mycosis fungoides developed severe conjunctivitis, corneal infiltrates and ulcers. At autopsy specific infiltrations were found in the conjunctiva, in the cornea and especially in the choroid at the posterior pole. (6 illustrations, 12 references) Frederick C. Blodi.

Hager, G. **Observations on sympathetic ophthalmia, Vogt-Koyanagi's syndrome and Harada's disease.** Klin. Monatsbl. f. Augenh. 131:89-101, 1957.

A 42-year-old woman with chronic, bilateral uveitis, meningo-encephalitis, inner ear deafness, alopecia and poliosis is described. Every treatment, including iridectomy, remained without avail. The right eye had to be enucleated, the left eye became blind. The histologic picture resembled sympathetic ophthalmia. It is assumed that all three conditions are produced by the same agent which reaches the eye through a perforation in sympathetic ophthalmia. In the other two the agent enters the body via the respiratory or gastrointestinal system, reaches the diencephalon via the blood stream and finally affects the eyes. (2 figures, 84 references) Frederick C. Blodi.

Kapuscinski, W. J., Ogielski, L. and Ogiolska. **Experiments on hypersensitivity and bacterial invasion as etiologic factors of iridocyclitis.** Bull. et mém. Soc. franç. d'opht. 69:168-181, 1957.

In this remarkable study on the etiology of uveitis, new emphasis was placed on the investigation of the aqueous. Six-

teen rabbits were sensitized with horse serum and three weeks later serum of the same horse was injected into the anterior chamber. The result was a hyperergic iridocyclitis. The second group consisted of 14 rabbits. Their anterior chamber was inoculated with a pure culture of staphylococcus aureus. Twelve rabbits of this series showed a mucorpurulent iridocyclitis and two rabbits had a panophthalmitis. Anterior chamber punctures were performed during the height of the disease. The content of the anterior chamber was examined using the biochemical reactions of Kolobolocki. The basic process of this test is the perfection of a stable union of kresol blue and methylen blue with silver salts and bacterial toxins. The resulting compound does not discolor when exposed to potassium permanganate. The test is positive with bacterial toxins, culture extracts and cultures. It also is positive with blood serum. It is negative with primary and secondary human aqueous, also with the primary aqueous of the rabbit but weakly positive with the secondary aqueous of the rabbit. In the 14 rabbits inoculated with staphylococcus aureus the reaction of Kolobolocki was positive; it was negative in the 16 rabbits injected with horse serum. In acute cases of human iridocyclitis the reaction is always positive; it is negative in most cases of chronic iridocyclitis. Attention was called to the possible role of anaphylactic hypersensitivity as an important factor in propagation and in inciting secondary location in focal infections of the eye, also to the potential role of chemical products of bacterial origin. These conclusions, however, were considered to be hypothetical. (2 tables, 26 references)

Alice R. Deutsch.

Kessler, Julius. **The resistance of the tissue of the iris and the form of the iris.** A.M.A. Arch. Ophth. **57**:840-841, June, 1957.

The author claims there is peripheral protrusion of the iris during pupillary movements, and believes that weakness of the peripheral segment may be a primary causative factor in cases of narrow angle and angle closure. G. S. Tyner.

Krasnov, M. and Shulpina, N. **The treatment of uveal glaucoma.** Vestnik oftal. **3**:13-18, May-June, 1957.

Uveal glaucoma was observed in 59 eyes of 44 patients, most of whom were over 50 years of age, during 1954 and 1955. In 31 patients the course was chronic and in 13 there was a sudden onset with pain, nausea, vomiting and impairment of vision. Signs of uveitis were edema of the endothelium, and precipitates and opacities of the vitreous. In five patients there was edema of the optic nerve. The visual fields were contracted, with a nasal defect in 18 patients. Tuberculosis was established in 19 patients. In all but four patients mydriatics lowered the ocular tension. Iridectomy was done in eyes which did not respond to miotics or mydriatics and in those which had impairment of the function and excavation of the optic disc. There was intraocular hemorrhage in three of the patients. Early operation is indicated in these cases. In patients who had been treated conservatively for a long time, operation gave no results.

Olga Sitchevska.

9

GLAUCOMA AND OCULAR TENSION

Bunge, R. P., Danforth, R. C. and Settlage, P. H. **Effects of intravenous urea on intraocular pressure in the monkey.** A.M.A. Arch. Ophth. **57**:659-667, May, 1957.

Intravenous urea produced a decreased ocular pressure of about 15 scale units on a McLean tonometer over a three-hour period. (4 figures, 2 tables, 23 references)

G. S. Tyner.

Carreras, Marcelo. **A falacious campimetric sign of incipient glaucoma.** Arch. Soc. oftal. hispano-am. 17:55-71, Jan., 1957.

The material of this investigation consisted of 889 clinical histories containing visual field studies. The analysis of the data compiled from these histories reveal such a marked lability of the 1/2,000 isopter, as to make it useless for clinical studies. The most reliable data are obtained by the classical investigations with 3/333 and 1/333, combined with 5/2,000 for the blind spot and 2/2,000 on the Bjerrum screen. Baring of the blind spot was not discovered with 2/2,000 isopter in 11 cases of established glaucoma. Contraction of the central isopters with baring of the blind spot was found in 42 non-glaucomatous eyes; these comprised six cases of incipient senile cataract, five of papilledema, five of moderate myopia, three of bitemporal hemianopsia, two of homonymous hemianopsia, six of hypertensive retinopathy in two of which angiospastic neuroretinitis followed, five of choroidal sclerosis, one of diabetic retinopathy, two of uveiits, one of papillitis, one of incomplete Foster-Kennedy syndrome, one of incomplete simple atrophy of the optic nerve; two of senile macular degeneration, one of coloboma of the optic nerve; one of an inferior conus, one of choroidal nevus; and one case of hysteria. In a group of eight patients with unilateral absolute glacoma, observed over a period of two to six years, in whom the other eye remained normal clinically, baring of the blind spot was found in two normal eyes while they were under the influence of an instillation of pilocarpine. The Bjerrum scotoma and the narrowing of the 2/2,000 isopter disappeared in a glaucomatous eye while it was under the influence of a miotic which lowered the ocular tension. The conclusion emerging from this analysis is that a contraction of the internal isopters of the visual field with baring of the blind spot has no diagnostic value in chronic glaucoma, and that glaucoma may be present when these isopters are normal. (29 visual fields)

Ray K. Daily.

Chandler, Paul A. **Use and misuse of acetazoleamide (Diamox) in the treatment of glaucoma.** A.M.A. Arch. Ophth. 57:639-643, May, 1957.

The author believes the greatest ocular indication for Diamox is in the control of secondary glaucoma. In open-angle glaucoma it may be used as an adjunct to miotics in selected cases. In angle-closure glaucoma diamox should not supplant the employment of peripheral iridectomy. In treating angle-closure glaucoma diamox is a valuable preoperative medication to lower tension before surgery is performed. (2 references) G. S. Tyner.

Fritz, A. **The action of Diamox on the circulation of the glaucomatous eye.** Bull. et mém. Soc. franç. d'opht. 69:138-150, 1956.

The hemodynamic effects of Diamox on the circulation of the normal and glaucomatous eye were investigated. The movement of the blood in the anterior episcleral veins were observed by biomicroscopy. The amount of ocular compression which interrupts the blood flow in the anterior episcleral veins was called "pression d'arret." (P.A.) In the presence of a show formation of the aqueous a comparatively mild compression interrupted the blood flow in the episcleral veins, while the opposite, namely uninterrupted flow under increased pressure, took place during expeditious aqueous formation.

A large number of normal and glaucomatous eyes were examined. The ocular tension as measured with the Schiøtz tonometer was established simultaneously

with the P.A. measured with Bailliart's dynamometer. Whenever possible the arterial retinal pressure and the pressure of the iris capillaries were registered, dissociating the effect of Diamox on the arterioles, capillaries and veins. Diamox, probably because of the various pathologic vascular anomalies in chronic open-angle and congestive narrow-angle glaucoma, excites different results on the intraocular circulation in these two groups. In chronic open-angle glaucoma its action is equally beneficial to the intraocular blood flow while in congestive narrow-angle glaucoma, in spite of the frequent reduction in tension, the intraocular circulation was found to be impaired, an additional hazard during a stage of severe vascular stasis. These findings are not only of scientific but also of practical significance because of the frequent indiscriminate use of an otherwise highly serviceable drug. (4 figures, 11 references)

Alice R. Deutsch.

Kessler, Julius. **Modification of the Friedenwald-Kinsey formula of intraocular pressure.** A.M.A. Arch. Ophth. **57**: 687-688, May, 1957.

An alteration of the formula of the intraocular pressure of Friedenwald and Kinsey is suggested and discussed. (2 references)

G. S. Tyner.

Morrison, W. Howard. **Office management of glaucoma.** A.M.A. Arch. Ophth. **58**:225-234, Aug., 1957.

This valuable practical article on the various phases of gloucoma therapy should be read by everyone who treats this disease.

G. S. Tyner.

Vafina, R. **Posterior sclerectomy.** Vestnik oftal. **3**:27-28, May-June, 1957.

The ocular tension was measured in 220 eyes with glaucoma for which a posterior sclerectomy was done, before the operation, ten minutes after it, then on the second, fifth and tenth day after operation. There was lowering of the tension during 12 postoperative days but none after the 15th day and in further observations up to two and a half years. The depth of the anterior chamber was not changed by the operation. Posterior sclerectomy is of little value in the treatment of glaucoma.

Olga Sitchevska.

10

CRYSTALLINE LENS

Lock, J. A. N. **Electrical cataract produced by a 240-volt current.** Brit. J. Ophth. **41**:500-501, Aug., 1957.

The patient was exposed to injury by electricity of a 230 to 240 volt direct current. No previous record of such low voltage causing a cataract was found. There was a latent period of six weeks without blurring of vision and 12 weeks after injury an opaque white cataract was visible. The initial examination revealed a distinct anterior subcapsular lesion consisting of many discrete small multiform opacities with a few diffuse opacities in the deeper strata of the lens. A linear extraction was successfully performed. (1 figure, 1 reference)

Lawrence L. Garner.

Nirankari, M. S. and Maudgal, M. C. **A modification of the Smith Indian technique of intracapsular cataract extraction.** Brit. J. Ophth. **41**:487-491, Aug., 1957.

A modification of the Smith Indian cataract extraction procedure is described which has as its main purpose the elimination of the vitreous loss so prevalent with the original technique. This procedure must only be used in patients over 50 years of age with no evidence of abnormal increase in tension or subluxation of the lens. Backward pressure is made just inside the section at the limbus above and a hook is placed on the limbus below when the bulge is seen that is created by

the forward movement of the lower part of the equator of the lens. This lower hook breaks the lower zonular fibers by rotating the equator anteriorly. This creates a gutter and the lens is now held by backward pressure above and upward pressure in the lower part. With these two pressures the lens is tumbled out and the upper zonular fibers are broken as the hook sweeps across the lens. A widely dilated pupil defeats the purpose of the operation insofar as the vitreous is no longer protected by this diaphragm, therefore dilatation is performed by using only cocaine and adrenalin drops with the retrobulbar anesthetic. The molding of the lens as it is pushed through the tight iris diaphragm is likened to the delivery of a baby. Peripheral iridectomy or iridotomy is advised but at no time can a total iridectomy be performed. Vitreous prolapse occurred in 31 of 965 cataract extractions. (5 figures, 1 table, 5 references)

Lawrence L. Garner.

Pirie, A. and Flanders, P. H. **Effect of X-rays on partially shielded lens of the rabbit.** A.M.A. Arch. Ophth. **57**:849-854, June, 1957.

Several authors have shown that irradiation of the axial cone of the lens does not lead to any opacity, whereas irridiation of a sector of lens including part of the periphery causes opacities in the area irradiated. One wonders, therefore, what is the minimal area of the lens that must be irradiated to produce a complete opacity. The authors believe that a complete cataract develops only if more than three-quarters of the periphery of the lens is irradiated. It has been noted that, in those lenses which do not become completely opaque, the opacities, which originally lie immediately beneath the capsule, become, as time goes on, overlaid by clear lens fibers. (2 figures, 3 tables, 12 references)

G. S. Tyner.

Stams, A. **Prolapse of the iris during the Graefe section.** Klin. Monatsbl. f. Augenh. **131**:109-110, 1957.

If such a complication arises the cornea is massaged with a glass rod. This usually moves the iris upward and out of the way. (1 figure, 1 reference)

Frederick C. Blodi.

11
RETINA AND VITREOUS

Alagna, G. **The heparin-inhibition test in diabetic retinopathy.** Arch. di ottal. **61**:143-149, March-April, 1957.

Badin's heparin-inhibition test in patients with diabetic retinopathy indicates that this condition is probably associated with basic changes of the "fundamental substance" ("Sostanza Fondamentale"). (1 table, 13 references)

John J. Stern.

Alagna, G. **Mucoproteinuria in diabetic retinopathy.** Arch. di ottal. **61**:99-109, March-April, 1957.

Patients with diabetic retinopathy show an increase of mucoproteins in blood and urine. This finding suggests that the retinal lesions are part of a general mesenchymal disturbance, expressed by the increased excretion of mucoproteins. Their presence in the urine is checked easily and rapidly. (3 tables, 35 references)

John J. Stern.

Bonavolonta, Aldo. **Retinal detachment and Marfan's syndrome.** Gior. ital. oftal. **9**:533-545, Sept.-Oct., 1956.

Five cases of Marfan's syndrome are described, showing in addition retinal detachment of the usual type with multiple lacerations, and exhibiting a greater tendency to hemorrhage in the vitreous. (34 references)

V. Tabone.

De Vincentiis, Mario. **Late ophthalmoscopic changes in the macula and their pathogenesis in occlusion of the central**

retinal artery. Arch. di ottal. **61**:163-172, March-April, 1957.

The late effects of occlusion of the central retinal artery were studied with normal and red-free light in 14 cases. The peculiar macular disturbances which are observed are explained as results of a mild inflammation of the choroid which becomes more evident in the macula for anatomic reasons. (3 figures, 11 references) John J. Stern.

Fourcade, M., Vailhe, J. and Lavant, F. **Retinitis pigmentosa and the hypophyseal syndrome.** Ann. d'ocul. **189**:719-723, Aug., 1956.

The authors report a case of retinitis pigmentosa. The patient also had a hypoglycemia, a flat glucose tolerance curve, polyuria and scanty axillary and pubic hair. No other manifestations or signs of pituitary disorder were present; however, the authors feel that the findings given above are sufficient to make a diagnosis of "hypophyseal syndrome." They suggest evaluation of all patients with retinitis pigmentosa from this point of view. (6 references) David Shoch.

Gemolotto, Guglielmo. **A case of retinal detachment with double disinsertion and a macular hole.** Gior. ital. oftal. **9**:612-616, Sept.-Oct., 1956.

A patient with retinal detachment, a macular hole and double disinsertion was treated by diathermy. The retina became replaced and the final visual acuity was 3/60. (7 references) V. Tabone.

Hollenhorst, Robert W. **Diseases of the retina and optic nerve.** A.M.A. Arch. Ophth. **57**:744-782, May, 1957.

The year's literature is abstracted and discussed. (357 references)

G. S. Tyner.

Patz, A. and Eastham, A. B. **Oxygen studies in retrolental fibroplasia.** A.M.A. Arch. Ophth. **57**:724-729, May, 1957.

The authors conclude that gradual withdrawal of oxygen from premature infants may not be the management of choice because in mice this added amount of oxygen produced the ocular lesions in some instances. (9 figures, 9 references)

G. S. Tyner.

Scheie, H. G. and Hogan, T. F., Jr. **Angioid streaks and generalized arterial disease.** A.M.A. Arch. Ophth. **57**:855-868, June, 1957.

It is believed that angioid streaks of the retina and pseudoxanthoma elasticum are only part of a generalized elastic tissue degeneration. This paper adds ten patients to those previously reported, all of whom showed evidence of arterial disease. All of these patients had angioid streaks of the retina. Macular degeneration and pseudozanthoma elasticum were present in eight patients. Clinical signs of arterial disease were present in all patients. (12 figures, 27 references)

G. S. Tyner.

Sturman, R. M., Laval, J. and Weil, V. J. **Evaluation of scleral tucking procedure for retinal detachment.** A.M.A. Arch. Ophth. **58**:251-255, Aug., 1957.

The authors studied six eyes of white rabbits operated upon by the scleral folding technique as described by Everett. Their histologic studies indicate that this method has great merit in detachment surgery. (16 figures, 1 reference)

G. S. Tyner.

Tiberi, G. F. **A case of juvenile exudative retinopathy.** Gior. ital. oftal. **9**:644-658, Nov.-Dec., 1956.

A patient is described in detail who had central exudative retinopathy as well as optic atrophy in both eyes. The relation between the two conditions as well as their nature are discussed and the view is expressed that the former is tubercu-

lous in nature whereas the latter is due to alcohol. (1 figure, 24 references)

V. Tabone.

12

OPTIC NERVE AND CHIASM

François, J., Verriest, G. and Beheyt, J. **Differential diagnosis between papillitis with normal vision and papilledema.** Ann. d'ocul. **189**:669-680, Aug., 1956.

It is often difficult to differentiate an optic neuritis from papilledema. The authors list some of the differentiating characteristics. Optic neuritis is usually unilateral, papilledema usually bilateral; the level of albumin in the aqueous is high in papillitis, normal in papilledema; central vision is usually markedly reduced in papillitis but usually normal in papilledema. The authors believe that the best test for differentiating these two conditions is the visual field. In papilledema there is a pericecal scotoma due to edema of the retina around the nerve. This may also be present in papillitis but in addition there are always central, paracentral and peripheral defects, the result of defects of nerve fiber bundles. Six cases are presented to illustrate this point. (7 figures, 18 references) David Shoch.

Milosević, B. and Litričin, O. **The illusion of a primary melanoma of the optic disc.** A.M.A. Arch. Ophth. **58**:217-224, Aug., 1957.

Only about 30 cases of tumor of the optic disc have been reported, but these include cases which originate from the surrounding tissues. This paper deals primarily with pigmented tumors, only ten of which have been described. A complete report is given of a case in which the diagnosis seemed to be primary tumor of the optic disc, until the sections showed that it had been derived from the adjacent choroid. (12 figures, 10 references)

G. S. Tyner.

13

NEURO-OPHTHALMOLOGY

Bonhoure, C. **The rickettsioses in the etiology of optico-chiasmatic arachnoiditis and uveitis.** Ann. d'ocul. **189**:644-656, July, 1956.

Rickettsial diseases are apparently quite common in the Far East and the author stationed with French troops in Indochina reports seven cases of ocular lesion in patients with various rickettsioses. There was one case of scrub typhus, three of boutonneuse fever, two of murine typhus and one of undetermined origin. In five of these cases there was an opticochiasmal arachnoiditis. In addition several patients had lesions of the choroid (macular in one case) and two patients had retinal detachment. In all cases the diagnosis was made by positive serologic reactions to the appropriate antigen. The author feels that in all probability Harada's disease is a manifestation of Tsutsugamushi fever (which is common in Japan) and that many cases of meningouveitis are probably rickettsial in origin. David Shoch.

Palomar Collado, F. **Partial anopsias. Campimetric changes, diagnostic of intracranial pathology.** Arch. Soc. oftal. hispano-am. **17**:177-192, Feb., 1957.

The author advocates that the chapter on hemianopsia in ophthalmological textbooks be entitled "Partial Anopsias" and that it comprise all lesions of the optic pathways which manifest themselves by the loss of a large or small bilateral sector defect of the visual fields, related to the distribution of the nerve fibers from the optic nerves to the visual cortex. This includes hemianopsias, quadrant anopsias, and homonymous defects. The author proposes a classification based on the extent and localization of the visual field loss and an original diagnostic chart to facilitate the intracranial localization of

lesions with visual field defects. The chart is based on designs proposed by various authors. The peripheral defects are identified by number, and the topography of the corresponding central lesions by Roman numerals. A quotation mark differentiates the left eye from the right; and a semilune the temporal field from the nasal. Four cases are reported to demonstrate the value of careful and detailed perimetry and campimetry: 1. inferior right quadrant anopsia caused by an arteriovenous aneurism of the occipital cortex, 2. blindness in one eye and temporal hemianopsia in the other, in which a large cellar cyst was found at operation, 3. right superior irregular and incomplete quadrant anopsia with an enlargement of the blind spot (the lesion was localized in the left temporal lobe, the lobe was resected and the pathologic anatomy was that of an arteriovenous malformation consisting of telengiectatic and hemangioblastic areas), and 4. total blindness in the right eye and temporal hemianopsia with a restriction of the nasal field in the left eye (at the operation a large intrasellar and extrasellar cystic neoplasm was removed). It is emphasized that visual field studies afford the opportunity for the early diagnosis of intracranial lesions, which in some cases may demand emergency surgery, and in others lead to surgery at a time when it may save the life of the patient. Extension of the lesion makes the prognosis of late surgery considerably graver. It is the responsibility of the ophthalmologist to recognize the early signs of these tumors, and to alert the neurologist and neurosurgeon to the presence of the intracraneal lesion. (11 figures, 25 references) Ray K. Daily.

Shubova, T. and Konchakova, M. **The significance of eye symptoms in the diagnosis of multiple sclerosis.** Vestnik oftal. **3**:24-25, May-June, 1957.

The authors observed 66 patients with multiple sclerosis, aged 20 to 55 years. In 16 patients there was complete optic atrophy, in nine the temporal side of the disc was pale; two patients had optic neuritis and in two there was transitory papilledema. In a number of patients narrowing of the retinal arteries was observed. In eight patients there was sudden loss of vision or greatly impaired vision in one eye, which gradually returned to normal. There was a hemianopsia in two patients, a ring scotoma in one and a few had moderately constricted fields; in 46 patients the visual fields were normal. Nystagmus, which is caused by the affection of the vestibular system, was present in 48 patients. Diplopia was a frequent symptom. In 17 patients there was aniscoria. All these signs may aid in a correct diagnosis of multiple sclerosis in an early stage. Olga Sitchevska.

Weber, Joachim. **Etiology of lacrimal hyposecretion, conjunctivitis sicca and keratoconjunctivitis sicca.** Klin. Monatsbl. f. Augenh. **131**:78-89, 1957.

Nine cases are described in which the dry eye was caused by a lesion in the pons near the upper salivary nucleus or its afferent or efferent connections. Such central lesions may be a common cause of Sjøgren's syndrome. (5 figures, 1 table, 35 references) Frederick C. Blodi.

14

EYEBALL, ORBIT, SINUSES

Cavka, V. **A new form of viral orbital cellulitis.** Ann. d'ocul. **189**:699-711, Aug., 1956.

Twelve cases of benign, epidemic, viral orbital cellulitis in children are described. Common findings are: a palpebral edema and ptosis, conjunctival hemorrhages, exophthalmos, regional adenopathy and blood findings of a viral infection. Eleven patients recovered uneventfully, one had a loss of vision due to an associated optic

neuritis. In all cases bacteriologic culture was negative. There seemed to be a good response to aureomycin therapy. (4 figures) David Shoch.

Devignes, P., Dagorne and Brun. **Two cases of orbital cylindroma.** Bull. et mém. Soc. franç. d'opht. 69:220-224, 1956.

Cylindromas are very malignant tumors in spite of their comparatively slow growth. They originate from the epithelium of either the lacrimal gland, subsidiary conjunctival glands or from the mucous membrane of the sinus. Their pathologic structure is characteristic, namely strands of epithelial cells, containing cavities or fibrilles and taking on special stains, a blue color with thionine and a rose color with mucicarmin. Mucinous degeneration of the interstitial stroma was also found. Mixed tumors often present, at least partly, similar structures. Local recurrences are frequent, not always exactly at, or even close to, the original lesion. Invasions of the bony orbit, the pterigomaxillary fossa, the sinus, the meninges and of the base of the brain have been described. Distant metastases are rarely seen. The clinical picture is not always easy to evaluate. A slowly increasing exophthalmos in a young person accompanied by severe orbital pain is suggestive. Unfortunately a biopsy is necessary to confirm the diagnosis in spite of the known fact that interventions of any kind promote growth and recurrence of the tumor. Radiotherapy is the treatment of choice. High doses of penetrating X rays and multiple exposures are suggested as the most adequate treatment (4,000 to 4,500r per field, 8,000-9,000r per treatment).

The two cases observed by the authors demonstrated the characteristic signs and symptoms of these tumors. In the first case, in a 24-year-old woman, the original tumor was in the orbit; in the second case, that of a 55-year-old man, the primary growth was in the antrum. Both patients had multiple operations because of recurrences, including exenteration of the orbit and extensive irradiation but finally succumbed to intracranial extension of the tumor. Alice R. Deutsch.

Dollfus, Legrand and Baclese. **A case of eosinophilic granuloma of the orbit.** Bull. et mém. Soc. franç. d'opht. 69:192-202, 1956.

The eosinophilic granuloma of the orbit is a rare disease; it may manifest itself as a single lesion, as a fistulating growth of the upper lid or the external palpebral angle, or it may appear in disseminated form, simultaneously at various locations. The X-ray picture, demonstrating sharply outlined defects without periosteal thickening is more or less typical. Pathologically it consists of granulation tissue characterized by its polymorphism, containing plasmocytes, lymphocytes, pseudoepithelial xanthogranulomatous reticulocytes and multinuclear eosinophiles. The latter however are not always present. The absence of tissue destruction differentiates the lesion from specific and nonspecific inflammatory disease. Many authors consider the eosinophilic granuloma as a benign variation of Schüller-Christian disease or Letterer-Siwe disease. It occurs mostly in children; in spite of its usually favorable prognosis it may lead to serious complications when affecting the orbit. The treatment is often surgical but X ray with or without simultaneous hormone therapy seems to be the more appropriate treatment at present. Cases of spontaneous recovery also were observed. The case history of a three-year-old child with a localized orbital lesion is reviewed in detail. Emphasis is placed on the difficulties in the diagnosis of early lesions. (7 figures) Alice R. Deutsch.

Larmande, A. M. **Radiographic aspects of some rare tumors of the orbital roof.**

Bull. et mém. Soc. franç. d'opht. 69:183-191, 1956.

The tumors of the orbital roof, because of their close relationship to bony structures, present a more or less distinctive radiologic picture; this is especially conspicuous on tomography and stereography. Additional characteristic signs and symptoms include pronounced exophthalmos, inferior displacement of the eyeball without early ptosis or impairment of motility, and severe, occasionally excruciating pain.

Three case histories are discussed; the first in an 18-year-old man with a right supraorbtal growth which was removed by a trans-cranial route. The pathologic diagnosis was questionable and designated as either osteoid osteoma or osteogenic fibroma. The second case occurred in a 37-year-old man. He presented a slowly progressive left exophthalmos. The EEG showed some abnormalities in the anterior lead. There was also a bilateral purulent infection of the nose. The X ray showed a distinct newgrowth of the left frontoörbital region including the lesser wing of the sphenoid with invasion of the frontal sinus. The tumor presented an arborescent structure with many small calcium deposits, characteristic X-ray appearance of an angioösteoma. The diagnosis could not be verified on biopsy because of a severe interfering hemorrhage and insufficient excised material. The third case, in a 35-year-old man, was characterized by bilateral progressive exophthalmos and a dense hyperostosis of both orbital roofs on tomography. The biopsy showed typical tuberculous lesions without caseation, and justified the diagnosis of bilateral tuberculous orbital periositis. Tumors of the orbital roof, because of possible intracranial dissemination, should not be explored through transnasal routes. (4 figures) Alice R. Deutsch.

Paufique, L., Etienne, R. and Charleux, J. **Pulsating exophthalmos caused by orbital malformations in Recklinghausen's disease.** Bull. et mém. Soc. franç. d'opht. 69:203-219, 1956.

Structural changes of the bone are of great significance in the course of Recklinghausen's disease; segmentary osteohypertrophy with hypertrophy of the adjoining connective tissue and nerves occur simultaneously with the formation of isolated or multiple defects of bone. Whenever bony defects occur in the orbit they are generally accompanied by an elephantiasis of the lids. The orbital walls either show small fissure-shaped defects or they are more or less completely destroyed. In extreme cases even complete loss of the lesser wing of the sphenoid, its major wing, optic canal and orbital fissures, with or without regressive features on the base or surface of the skull, have been described. The concomitant exophthalmos is more or less pronounced; the place of insertion of the eye muscles is restricted to a residual membrane, as the apex of the orbit has disappeared. The eyeball itself and the fundus are usually normal. The exophthalmos increases on stooping, holding of breath or compression of the homolateral jugular vein. A pulsation of the eyeball is also described. This type of pulsation is caused by the prolapse of intracranial content into the orbit and transferred brain pulsation. Thrills or subjective bruits are absent. The palpation through the enlarged orbital entrance confirms the presence of a soft, pulsatile mass. The X-ray findings are characteristic, so are accompanying peripheral signs of neurofibromatosis such as pigmented areas in the skin and defects of the skeleton. An arteriovenous fistula is easily excluded. It is more difficult to exclude intraorbital soft tissue tumors of different etiology. The treatment is surgical. Osteoperiosteal autografts alone or in combina-

tion with plastic substances were used to cover at least partly the extensive body defects. Additional technical difficulties are the division of meningeal adhesions and the repair of a meningocele. Two case histories are discussed in detail. (10 figures, 30 references)

Alice R. Deutsch.

Van Arnam, C. E. and Fine, M. **Orbital metastasis of renal carcinoma.** A.M.A. Arch. Ophth. **57**:694-701, May, 1957.

Two cases of this condition are reported. The authors are optimistic concerning the treatment. Local excision may effect a cure when the tumor is discovered early and is well isolated. (13 figures, 7 references) G. S. Tyner.

15

EYELIDS, LACRIMAL APPARATUS

Alajmo, Arnaldo. **A case of a palpebral anthrax boil with benign course.** Arch. di ottal. **61**:111-116, March-April, 1957.

An anthrax infection of the lower lid was treated successfully by "high doses" of penicillin, sulfonamides and local antiseptic ointments. No anthrax antiserum was used. (2 figures, 1 reference)

John J. Stern.

Hanney, Franz. **Drainage of tears with restricted movements of the upper lid.** Klin. Monatsbl. f. Augenh. **131**:69-72, 1957.

In order to test the importance of movements of the upper lid for the drainage of tears 25 patients with insufficient lid closure were examined. They had previously been operated on for a congenital ptosis and the deficiency varied from 2 to 4 mm. Only three patients had a poor tear drainage and this could in all instances be explained on the basis of some other pathologic changes. Normal movement of the upper lid is therefore not necessary for an adequate drainage of the tears. (20 references)

Frederick C. Blodi.

Kask, Henrik. **High doses of vitamin B_{12} in ocular diseases.** Klin. Monatsbl. f. Augenh. **131**:101-103, 1957.

Beneficial results were obtained in 30 patients with retrobulbar neuritis, tobacco amblyopia, herpes corneae or some complications of iridocyclitis. (1 table, 21 references) Frederick C. Blodi.

Németh, Bélah. **Transposition of the lacrimal punctum.** Klin. Monatsbl. f. Augenh. **131**:104-107, 1957.

When epiphora is due to eversion of the punctum the latter can be transplanted inward in a Z-like plastic operation with a conjunctival flap. (3 figures, 23 references) Frederick C. Blodi.

Palich-Szántó, Olga. **Disturbances in the growth of the lashes.** Klin. Monatsbl. f. Augenh. **131**:107-109, 1957.

Two patients are described in whom one or a few lashes of the upper lid suddenly grew beneath the skin and had to be epilated. (3 references)

Frederick C. Blodi.

Spaeth, Edmund B. **Carcinomas in the region of the lacrimal sac.** A.M.A. Arch. Ophth. **57**:689-693, May, 1957.

The author presents three cases to illustrate the course of treatment of lacrimal sac carcinoma. Essentials of treatment are extensive primary surgery of the region, which should include opening of the entire length of the nasal-lacrimal duct; evisceration of the orbit if there is a recurrence, and associated X-ray therapy. (6 figures, 9 references) G. S. Tyner.

Starke, H. **Ptosis operation of Blaskovicz.** Klin. Monatsbl. f. Augenh. **131**:110-112, 1957.

A simplified method is devised for

adults and older patients. It is indicated for smaller degrees of ptosis. Three sutures are preplaced through the levator and the conjunctiva which need not to be mobilized. The tarsus is then resected and the three final sutures are placed through conjunctiva, levator and skin. (2 figures, 3 references)

Frederick C. Blodi.

16
TUMORS

Blatt, N., Popovici, V. and Regenbogen, L. **Contribution to the study of epithelioid-nodular reticulosis of the Besnier-Boeck-Schaumann type.** Ann. d'ocul. **189**: 760-770, Sept., 1956.

The authors report the case of a young man with a firm tumor of the lacrimal gland. This was extirpated and on histologic section a "tuberculoid" structure was seen. This consisted of nodules of epithelioid cells surrounded by lymphocytes. Neither giant cells nor caseation was seen. A diagnosis of Besnier-Boeck-Schaumann syndrome was made. The authors feel that this may be the same as Heerfordt's disease where the process is localized in the uvea. The diagnosis, prognosis and treatment of these reticuloendothelioses is presented. (2 figures)

David Shoch.

Das Gupta, B. K. and Roy, S. **Ocular metastases in Hutchinson-Pepper syndrome.** A.M.A. Arch. Ophth. **57**:821-831, June, 1957.

The author reports what he believes to be the first case in which there were ocular metastases in a case of Hutchinson-Pepper syndrome (neuroblastoma of the adrenal gland with involvement of the liver and the orbit). (12 figures, 48 references.

G. S. Tyner.

Halbron, P., Cohen, A., Mawas, H. and Wekstein, C. **A case of hereditary and familial glioma of the retina.** Ann. d'ocul. **189**:790-796, Sept., 1956.

The authors report the case of an infant with bilateral retinoblastoma. Typical clinical, radiologic and histologic data are presented. A cousin also was reported to have had a unilateral retinoblastoma. In the case reported bilateral enucleation was performed. (3 figures)

David Shoch.

Lepri, G. and Andreani, D. **Ocular manifestations of multiple myeloma.** Gior. ital. oftal. **9**:546-559, Sept.-Oct., 1956.

A case of multiple myeloma in which the first clinical sign was a bilateral thrombosis of the central retinal vein is described in detail. The ocular manifestations of the disease according to Clarke (1954) are reviewed. Likely causes of these ocular manifestations might be changes in the blood proteins, increased viscosity and toxic alterations of the endothelium of the vessels; the above findings are associated with paraproteinemia. (71 references)

V. Tabone.

Roberts, D. St. C. **Benign calcifying epithelioma.** Brit. J. Ophth. **41**:492-499, Aug., 1957.

Roberts describes 35 calcifying epitheliomas of which 80 percent were found in the head and neck and half of these were near the eye. Characteristic histologic features were noted; the clinical manifestations varied considerably. Granulation or granulomatous reaction is not essential to the diagnosis, calcification was noted in only 25 percent of the cases and this also could not be used as essential to the diagnosis. Diagnostic criteria are the presence of basal cells arranged in irregular clumps or bands and ghost cells composed of eosinophilic masses. The clumps of basal cells if seen alone could easily be mistaken for basal-cell carcinoma unless seen in conjunction with adjacent cellular tissues. The exact eti-

ology is not known although a familial occurence is noted. No recurrence followed surgical removal. (3 figures, 3 tables, and 22 references)

Lawrence L. Gardner.

17

INJURIES

Casanovas, J. and Angeles Diaz, M. **Accidental inclusion of eyelashes in the anterior chamber.** Arch. Soc. oftal. hispanoam. **17**:139-144, Feb., 1957.

Two cases of traumatic cataract with inclusion of lashes in the anterior chamber are reported. The accidents occurred two years before the examination in one case, and one year before in the other. The lashes were removed at the time of the extraction of the traumatic cataract and recovery was uneventful. The literature is reviewed and it is suggested that in general watchful waiting is the procedure of choice, except in the event of surgery for traumatic cataract, in case of intolerance of the lashes, or when the patient cannot be kept under observation for economic reasons. (1 figure, 10 references)

Ray K. Daily.

Ivanov, V. **Burns of the eye with bile.** Vestnik oftal. **3**:25-26, May-June, 1957.

Intense burning and epiphora, edema of both lids and marked conjuctival congestion of the lower lid followed the accidental introduction of bile from the gall bladder of a goose into the left eye. In two days there was necrosis of the conjunctiva of the lower lid, necrosis in the lower quadrant of the eyeball and subconjunctival hemorrhage. These signs gradually disappeared in a few days under treatment with antibiotics. The changes were evidently caused by the bile acids.

Olga Sitchevska.

Krasnov, M., Tokareva, B. and Shartz, S. **Subconjunctival injuries of the sclera.** Vestnik oftal. **4**:23-27, July-Aug., 1957.

This is a report on 23 patients who suffered from subconjunctival tear of the sclera; the ages ranged from 8 to 72. The site of the tear was in the region of the ciliary body in 15 eyes, in the region of the angle of the chamber in five and behind the equator in three eyes. The authors emphasize the point that in every case in which a scleral tear is suspected surgical interference should be undertaken at once; the incision of the conjunctiva should be made beyond the suspected scleral tear, the perforated sclera and conjunctiva should be sewed separately.

The subconjunctival scleral tears are localized mostly in the anterior segment of the eyeball. As soon as the tear is localized, careful surgery should be done with removal of the prolapsed (iris, ciliary body, lens) tissues and careful suturing of the scleral wound. This procedure saved all the eyes (some severely injured) with retention of useful vision in most of the eyes. Surgical interference should be undertaken at a later stage if the diagnosis was not made soon after the injury of the eye. The conservative approach of waiting is not rational, as any traumatized eye should have a surgical study at once.

Olga Sitchevska.

18

SYSTEMIC DISEASE AND PARASITES

Beattie, C. P. **Clinical and epidemiological aspects of toxoplasmosis.** Tr. Roy. Soc. Trop. Med. & Hyg. **51**:96-103, March, 1957.

In patients with full-blown toxoplasmosis, some 90 percent show chorioretinitis, and 60 percent have neurological signs and intracranial calcification. About half have hydrocephaly or microcephaly. Microphthalmus, nystagmus, strabismus, cataract, iritis, optic atrophy, and persistent pupillary membrane are also found. An acquired form of toxoplasmosis is described which is characterized by lymph-

adenopathy, and may be febrile or afebrile. It occurs in children and young adults. Chorioretinitis may occur in this form also.

It has been shown that people who handle animals have a higher incidence of positive dye tests than the average. Evidence suggests that the method of transmission is respiratory, and that the incidence in the population is high. The relative rarity of morbidity is explained by the variations in virulence of the organisms, the number in the infection, and the resistance of the host. (2 figures, 1 table, 40 references) Harry Horwich.

Cathie, I. A. B. **An appraisal of the diagnostic value of the serological tests for toxoplasmosis.** Tr. Roy. Soc. Trop. Med. & Hyg. **51**:104-110, March, 1957.

This work supports the specificity of the dye test in man. Trichomonas and trypanosomes should not be considered a source of confusion, contrary to the opinion of other investigators. Malaria does not interfere with the complement fixation tests; and properdin does not interfere with the dye test. There is, however, something in sheep serum which may modify toxoplasms, and something in human sera which may modify sarcospores. However, this does not decrease the validity of the dye test, especially if the serum has been inactivated first. (1 table, 25 references) Harry Horwich.

Chentzova, O. **Collagen disease.** Vestnik oftal. **3**:61-64, May-June, 1957.

This is a detailed survey of the foreign ophthalmologic literature (chiefly of the U.S.). Periarteritis, dermo-myositis, scleroderma, lupus erythematosa, rheumatoid arthritis, their histopathologic picture, the eye signs and symptoms, and specific treatment directed against the changes in the connective tissue are reviewed in detail. Olga Sitchevska.

Kennedy, J. J. and Cope, C. B. **Intraocular lesions associated with sickle-cell disease.** A.M.A. Arch. Ophth. **58**:163-168, Aug., 1957.

Of 20 patients with sickle-cell disease, on whom electrophoresis of the hemoglobin was done, four had intraocular abnormalities. These experiments and previous publications indicate that there is a causal relationship between recurrent intraocular hemorrhage and sickle-cell disease, especially of the hemoglobin S-C variety. (2 figures, 22 references)

G. S. Tyner.

Kornzweig, A. L. and Bassen, F. A. **Retinitis pigmentosa, acanthrocytosis, and heredodegenerative neuromuscular disease.** A.M.A. Arch. Ophth. **58**:183-187, Aug., 1957.

The authors report a third case of a very uncommon disorder consisting of early celiac disease, progressive ataxic neuropathy, and a peculiar malformation of the red blood cells known as acanthrocytosis. The parents were consanguinous. The neurological and ocular symptoms have progressed during the eight years of observation. (4 figures, 3 references)

G. S. Tyner.

Liebman, Sumner D. **Riley-Day syndrome (familial dysautonomia).** A.M.A. Arch. Ophth. **58**:188-192, Aug., 1957.

The author analyzes 19 patients with this syndrome of corneal changes and dehydration symptoms. Ten of the 19 showed some corneal abnormality. Apparently fifth nerve weakness with corneal anesthesia, diminished lacrimation and possibly "trophic disturbances" are fundamental to the development of the corneal lesion. Methyl cellulose drops, a bland ointment and a tarsorrhaphy are indicated. (1 figure, 20 references)

G. S. Tyner.

NEWS ITEMS

EDITED BY DONALD J. LYLE, M.D.
411 Oak Street, Cincinnati 19, Ohio

News items should reach the editor by the 10th of the month. For adequate publicity, notice of postgraduate courses and meetings should be received three months in advance.

DEATHS

Dr. William W. Blair, Pittsburgh, Pennsylvania, died June 12, 1957, aged 90 years.

Dr. Samuel Morse, New York, New York, died July 5, 1957, aged 70 years.

Dr. Charles Augustus Young, Roanoke, Virginia, died July 25, 1957, aged 67 years.

ANNOUNCEMENTS

CALL FOR PAPERS

The 1958 meeting of the Section on Ophthalmology will be held in San Francisco, June 23 to 27, 1958, simultaneously with that of the Association for Research in Ophthalmology.

Any one wishing to present a paper before the section is urged to communicate with Dr. Harold G. Scheie as soon as possible. A title and abstract of 50 to 150 words must be in his hands by January 1, 1958. Any one wishing to present a paper before the Association for Research should contact Dr. Lorand V. Johnson as soon as possible.

A $250.00 prize is offered for the best paper presented before the section at each scientific session.

Lorand V. Johnson, secretary
Association for Research in Ophthalmology
10515 Carnegie Avenue
Cleveland 6, Ohio

Harold G. Scheie, secretary
Section on Ophthalmology
313 South 17th Street
Philadelphia 3, Pennsylvania

CALL FOR EXHIBITS

The 1958 meeting of the Section on Ophthalmology will be held in San Francisco, June 23 to 27, 1958, simultaneously with that of the Association for Research in Ophthalmology.

Any one wishing to prepare a scientific exhibit should communicate with Dr. Frank W. Newell as soon as possible.

A $250 prize is offered for the best scientific exhibit prepared for the Section on Ophthalmology at each scientific session.

Frank W. Newell, M.D.
Representative to Scientific Exhibit
950 East 59th Street
Chicago 37, Illinois

RESEARCH STUDY CLUB

The Research Study Club of Los Angeles announces its 27th annual midwinter convention in ophthalmology and otolaryngology, January 20 through January 24, 1958, at the Ambassador Hotel, Los Angeles. Speakers in ophthalmology will be Dr. Frank B. Walsh, Baltimore; Dr. William F. Hughes, Chicago; and Dr. C. Allen Dickey, San Francisco. Instruction courses will be given by Dr. Dickey, and Dr. William J. Endres, Dr. S. Rodman Irvine, and Dr. Russell L. Stimson, Los Angeles.

All applicants must be members in good standing of the American Medical Association in order to become eligible for attendance at the convention. The fee for the entire course or any part of it is $110.00 and includes the cost of all round-table luncheons. Make the check payable to Research Study Club and mail to:

Dr. Norman Jesberg
500 South Lucas Avenue
Los Angeles 17, California

REFRESHER COURSE IN EYE SURGERY

The Faculty of Medicine of the University of Toronto offers a refresher course in eye surgery from March 24 to March 26, 1958. The guest surgeons will be: Dr. Willis S. Knighton, New York, and Dr. P. Robb McDonald, Philadelphia.

The instruction will consist of operative clinics in the university teaching hospitals in the mornings and formal clinics, lectures, and case presentations in the afternoons. The staff of the Department of Ophthalmology will contribute to the course, which will be given to a minimum of 15, with a maximum registration of 40 students. A fee of $35.00 will be charged, payable to the Chief Accountant, University of Toronto. Applications should be made to the Dean of the Faculty of Medicine, not later than January 31, 1958.

NEW ORLEANS ACADEMY

The midwinter convention of the New Orleans Academy of Ophthalmology will be held on February 24 through February 28, 1958, at the Roosevelt Hotel, New Orleans. The program, consisting of a symposium on uveitis, will be led by the following panel: Helenor Campbell Wilder Forester, Dr. Michael J. Hogan, and Dr. Samuel J. Kimura, San Francisco; Dr. Irving H. Leopold, Philadelphia; Dr. M. Puig Solanes, Mexico City; Dr. Floyd R. Skelton, New Orleans; and Dr. Alan C. Woods, Baltimore.

The registration fee of $75.00 includes associate membership in the academy for the year 1958, as well as all other features of the convention. Hotel reservations should be made early by writing directly to the:

Executive Secretary
New Orleans Academy of Ophthalmology
P.O. Box No. 469
New Orleans 1, Louisiana

Ohio postgraduate course

Speakers for the postgraduate course in ophthalmology to be held at the Ohio State Union Building, Ohio State University, Columbus, Ohio, March 3 and 4, 1958, will be: Dr. F. Bruce Fralick, Ann Arbor; Dr. William H. Havener, Columbus; Dr. Madge T. Macklin, Columbus; Dr. Algernon B. Reese, New York; Dr. William H. Saunders, Columbus; and Dr. Charles L. Schepens, Boston.

The registration fee for the course is $20.00 and all inquiries may be addressed to:

Dr. William H. Havener
Department of Ophthalmology
University Hospital
Columbus, Ohio

Sitapur Eye Hospital

The Sitapur Eye Hospital, U. P., India, offers two two-month courses in postoperative training in ophthalmology, particularly in eye surgery. The fee of $1,000.00 includes board and lodging. The first course began on November 1, 1957, and the second course opens on January 1, 1958. Apply to:

Chief Surgeon
Eye Hospital
Sitapur U. P., India

Treacher Collins Prize Essay

Under the title The Treacher Collins Prize Essay, the Council of the Ophthalmological Society of the United Kingdom has instituted a prize of £100, awarded triennially, for the best essay submitted upon a subject selected by the council. The prize shall be open to qualified medical practitioners of any nationality. The essay shall be written in the English language. The subject for the next award of the prize is "The eye in relation to the collagen diseases."

The winning essay may be published in the *Transactions* of the Ophthalmological Society, if the council so desires. The closing date for sending in essays for this award is December 31, 1959. Essays should be submitted to the Honorary Secretary, Ophthalmological Society of the United Kingdom, 45 Lincoln's Inn Fields, London, W.C.2, from whom also any further particulars can be obtained. No name should be on any essay, but a distinguishing pseudonym or quotation, which should be upon a sealed envelope containing the candidate's name and address, should accompany the essay.

New York University courses

New York University Post-Graduate Medical School, Department of Ophthalmology, New York, offers the following courses:

December 2 through 6, 1957: Surgery of the cornea (full time), under the direction of Dr. Ramon Castroviejo.

January 13 through 17, 1958: Neuro-Ophthalmology, under the direction of Dr. Alfred Kestenbaum.

February 20 through 22, 1958: Annual review of ophthalmologic advances, under the direction of Dr. A. Gerard DeVoe.

March 3 through 8, and March 10 through 14, 1958: Motor anomalies of the eye, under the direction of Dr. Harold W. Brown.

March 24 through 29, 1958: Surgery of the eye (full time), under the direction of Dr. Rudolf Aebli.

March 21 through April 4, 1958: Ophthalmic plastic surgery, under the direction of Dr. Sidney A. Fox.

For further information write to:

Office of the Associate Dean
New York University Post-Graduate Medical School
550 First Avenue
New York 16, New York

Miscellaneous

Blood samples needed

Medical researchers are urgently requesting small samples of blood from persons with retinitis pigmentosa for a new study of possible causes of the condition.

Investigators at The Jewish Hospital of Brooklyn hope that the samples may yield clues which will determine whether blood of people with the diseases is biochemically different than that of those in whom the condition does not exist.

Hospital authorities request prospective blood donors to address all inquiries to the "Retinitis Pigmentosa Project" in care of The Jewish Hospital of Brooklyn, 555 Prospect Place.

Dr. Albert E. Sobel, head of the Department of Biochemistry at the hospital, said blood samples should come from persons diagnosed as definitely having retinitis pigmentosa, preferably in its advanced stages. "We hope to find out whether changes in the body, such as metabolic difficulties, are mirrored by changes in eyesight," he explained.

Supervising the project is Dr. Mortimer A. Lasky, director of ophthalmology at the hospital. Dr. Harry Wagreish, associate professor of chemistry at the College of the City of New York, is the third member of the research team.

Mexican course

The Universidad Nacional Autonoma de Mexico Escuela Nacional de Medicina, Division de Graduado, gave a postgraduate course on "Strabismus in children," on September 18th through 30th, under the direction of the chief of the Department of Ophthalmology, Dr. M. Puig Solanes, assisted by the following professors: Encargado del Curso, Feliciano Palomina Dena, Honorario, and Manuel Márquez. Invited professors were: Dr. Teódulo Agundis, Manuel de Rivas Cherif, Efrén del Pozo, Anselmo Fonte Bárcenas, Enrique Graue, Julio Margo, Francisco Martínez Hinojosa, Ramón Olivera López, Marín Ramos Contreras, Daniel Silva, Jorge Velasco Alzaga, and Lino Vergara Espino.

The chiefs of the clinic were: Dr. Reñan Murillo

Fajardo, Dr. Lucina Villegas León, and Dr. Sabino Silva Zerón. Secretary of the course was Dr. Lucina Villegas León. The response was most enthusiastic and the course well attended.

Advanced training in research

The Public Health Service has announced a new program of financial support for advanced training of research scientists in the field of neurologic and sensory disorders. The new program, designed to help research scientists obtain additional specialized training for careers in teaching or research, will be conducted by the National Institute of Neurological Diseases and Blindness, of the Service's National Institutes of Health, Bethesda, Maryland.

Further information may be obtained by writing to the Chief, Extramural Programs Branch, National Institute of Neurological Diseases and Blindness, National Institutes of Health, Bethesda 14, Maryland.

Societies

Kansas City society

On the program for the November 21st meeting of the ophthalmology session of the Kansas City Society of Ophthalmology and Otolaryngology are: "Eye surgery," "Case report," Dr. John Bradford; "Presentation of interesting cases," Dr. Charles Crockett; "Stereo slides of the anterior chamber angle," Dr. Travis Robison. Dr. T. E. Sanders, Saint Louis, will be the guest speaker.

Other regular meetings of the society will be on January 16, February 20, and March 20, 1958. The annual post-graduate meeting to be held on April 7 to 11, 1958, will have as ophthalmic guest speakers Dr. R. Townley Paton, New York, and Dr. Arthur Jampolsky, San Francisco. The out-of-town meeting will be held at Hot Springs, Arkansas, on May 17, 1958.

Officers of the society for 1957-1958 are: President, Dr. Charles H. Steele; president-elect, Dr. Dick H. Underwood; vice-president, Dr. Willis-ton P. Bunting; secretary, Dr. James T. Robison; treasurer, Dr. Larry Calkins.

Milwaukee society

At the annual meeting of the Milwaukee Oto-Ophthalmic Society the following officers were elected for the year, 1958: President, Dr. E. Franklin Carl; vice-president, Dr. Lawrence L. Garner; secretary, Dr. Lee G. Eby.

Personals

Dr. Enrique Cipriani, Lima, Peru, has been elected Catediático Principal Asocicido en Oftalmologia of the Faculty of Medicine, San Marco University.

Dr. Richard Lambert Masland has been appointed assistant director of the National Institute of Neurological Diseases and Blindness, Bethesda, Maryland. Prior to his appointment Dr. Masland was professor of neurology and psychiatry and head of the neurology program at the Bowman Gray School of Medicine, Winston-Salem, North Carolina.

Dr. Conrad Berens and Dr. Arnold S. Breakey, New York, and Dr. John Harry King, Jr., Washington, D.C., will discuss the eye on the TV educational series "The World of Medicine," sponsored by Science Information Bureau, New York. The 13-program series opened over station WTTW, Chicago, on September 23rd.

Abstractors wanted

The Journal needs more abstractors of articles printed in English, French and German. Anyone wishing to volunteer please write to

Dr. F. H. Haessler
561 N. 15th Street
Milwaukee 3, Wisconsin

Abstractors find the activity not only interesting but valuable. Regular abstractors are given a free subscription to The Journal.

NEW ORLEANS ACADEMY OF OPHTHALMOLOGY

The Eighth Annual meeting of the New Orleans Academy of Ophthalmology will be held in New Orleans in the Roosevelt Hotel—February 24-28, 1958, featuring "Symposium on Uveitis." The registration fee of $75.00 includes associate membership in the Academy for the year 1958, as well as all other features of the convention. Hotel reservations should be made early by writing directly to the Executive Secretary, P.O. Box 469, New Orleans, La.

Urgent Request

The Uveitis Laboratory, University of California School of Medicine, San Francisco, is interested to obtain freshly enucleated eyes from patients with *all types of uveitis* and other endogenous inflammations. Attempts are being made to isolate etiologic agents from these eyes.

The eyes should *not* be fixed in preservatives or frozen, but placed in a sterile bottle, packaged, and shipped as quickly as possible. Please send specimens air express, special delivery, *collect*. Enclose history and findings and mark the package "Fresh Tissue Specimen—Rush."

A report of isolations of organisms and pathologic findings, including a slide, will be sent to the contributor. Credit will be given in any resulting publications if desired.

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Telegraph collect if specimen being sent. Send eyes to Samuel Kimura, M.D., Michael J. Hogan, M.D., or Phillips Thygeson, M.D., University of California School of Medicine, San Francisco 22.

A subscription to the Journal would be a most welcome gift to a friend.

Fill in the form at the bottom of this page and mail with your check (rates: domestic $12.00; Canadian and foreign $14.00) to Ophthalmic Publishing Company, 664 North Michigan Avenue, Chicago 11, Illinois.

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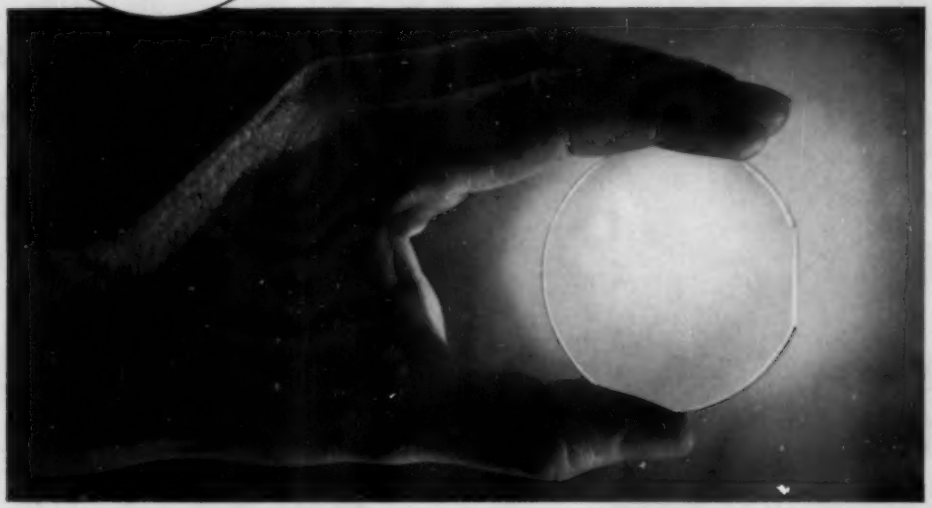

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